This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

UP

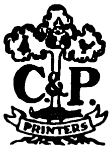
Coll., L.S.J.U., Nov. 1920, v.33-1.2

PROCEEDINGS

OF THE

ROYAL PHILOSOPHICAL SOCIETY

OF GLASGOW.


C&P.
PRINTERS

PROCEEDINGS

OF THE

ROYAL PHILOSOPHICAL SOCIETY OF GLASGOW.

VOL. XXXIII.

1901-1902.

EDITED BY THE ACTING SECRETARY.

PUBLISHED BY THE SOCIETY,
207 BATH STREET, GLASGOW.
1902.

Vol.	IX, (No. 1),	Price 2s. 6d.
Do.	IX., (No. 2),	„ 3s. 6d.
Do.	X., (No. 1),	„ 3s. 6d.
Do.	X., (No. 2),	„ 3s. 9d.
Do.	XI., (No. 1),	„ 4s. 0d.
Do.	XI., (No. 2),	„ 4s. 6d.
Do.	XII.,	„ 4s. 6d.
Do.	XIII., (No. 1),	„ 4s. 6d.
Do.	XIII., (No. 2),	„ 4s. 6d.
Do.	XIV.,	„ 10s. 6d.
Do.	XV.,	„ 10s. 6d.
Do.	XVI.,	„ 10s. 6d.
Do.	XVII.,	„ 10s. 6d.
Do.	XVIII.,	„ 10s. 6d.
Do.	XIX.,	„ 10s. 6d.
Do.	XX.,	„ 10s. 6d.
Do.	XXI.,	„ 10s. 6d.
Do.	XXII.,	„ 10s. 6d.
Do.	XXIII.,	„ 10s. 6d.
Do.	XXIV.,	„ 10s. 6d.
Do.	XXV.,	„ 10s. 6d.
Do.	XXVI.,	„ 10s. 6d.
Do.	XXVII.,	„ 10s. 6d.
Do.	XXVIII.,	„ 10s. 6d.
Do.	XXIX.,	„ 10s. 6d.
Do.	XXX.,	„ 10s. 6d.
Do.	XXXI.,	„ 10s. 6d.
Do.	XXXII.,	„ 10s. 6d.
Do.	XXXIII.,	„ 10s. 6d.

271379

CONTENTS OF VOL. XXXIII.

PAGES

I.—The Evolution of Solar Stars. By Professor Arthur Schuster, F.R.S., - - - - - - - - 1-35

II.—The Training of Teachers in Scotland. By James Knight, M.A., B.Sc., F.C.S., F.G.S., F.E.I.S., Head-Master of St. James's School, Glasgow, - - 36-70

III.—The Photography of Sound Waves and other Disturbances in Air. By H. Stanley Allan, M.A., B.Sc., - 71-80

IV.—The Relation of Economies to Numismatics. By W. W. Carlile, M.A., - - - - - - - - - 81-92

V.—The Criminal: some Social and Economic Aspects. By W. Miller Douglas, Superintendent, Marine Division, Glasgow Police, - - - - - - - 93-109

VI.—Thermal Emissivity. By J. W. Peck, M.A., - - 110-123

VII.—Rents and Ground Rents. Facts and Figures bearing upon the "Housing Problem." By William Fraser, F.S.I., Surveyor and Valuator, - - - - - 124-143

VIII.—Discussion on "Housing Problems." A contribution from the Economic Science Section. Opened by Professor William Smart, M.A., LL.D., - - - - 144-162

IX.—Plague in some of its Historical and Present Day Aspects. By Robert Macneil Buchanan, M.B., F.F.P.S.G., F.R.S.E., Bacteriologist to the Corporation of Glasgow, - - - - - - - - - - 163-179

X.—Joannes Matthæus and his Tract, "De Rerum Inventoribus." By John Ferguson, M.A., LL.D., F.R.S.E., etc., Professor of Chemistry in the University of Glasgow, - - - - - - - - - - 180-208

XI.—The Assyrians in the Judith. By David H. Crawford, M.A., - - - - - - - - - - 209-214

XII.—The Potential Difference necessary for a Double Spark Gap. By H. Stanley Allan, M.A., B.Sc., - - 215-218

PAGES

XIII.—Editions and MSS. of Wyntoun's "Cronykil." By F. J. Amours, B.A., Vice-President of the Historical and Philological Section, - - - - - - - 219-231

XIV.—On a Model for exhibiting a Classification of the Consonantal Sounds of the English Language. Shown by R. F. Muirhead, M.A., B.Sc., - - - - - 232-233

XV.—History in the Romance of Golagros and Gawayne. By George Neilson, President of the Historical and Philological Section, - - - - - - - 234-249

XVI.—Notes on Rural and Suburban Life in Scotland in the "Thirties." By David Lamb, - - - - - 250-266

XVII.—Note on Additional Experiments with the Electric Sonometer. By Professor James Blyth, M.A., LL.D., 267-268

XVIII.—Early Alliterative Verse. By John Clark, M.A., Hon. Secy., Historical and Philological Section, - - 269-286

XIX.—A Summary of Statistics relating to Vaccination and Smallpox as observed in the Cases admitted to the City of Glasgow Smallpox Hospital, Belvidere, between 10th April, 1900, and 30th June, 1901. By R. S. Thomson, M.D., D.Sc., F.F.P.S.G., F.R.S.E., and Robert Fullarton, M.A., M.B., Ch.B., - - - 287-313

XX.—The Genealogy of MSS. and Texts, with special reference to recent Chaucerian Investigations.—Summary. By W. S. M'Cormick, M.A., LL.D., - - - 314

XXI.—Huchown of the Awle Ryale and his Poems, examined in the Light of Recent Criticism.—Summary. By J. T. T. Brown, - - - - - - - - 315-316

Rules Governing the Competition for the Graham Medal, - - 317

Minutes of Session 1900-1901, - - - - - - - - 318-339

Office-Bearers of the Society, - - - - - - - - 340

Office-Bearers of the Sections, - - - - - - - 341-342

Committees appointed by the Council, - - - - - 343

Additions to the Library, - - - - - - - - - 344-350

Exchanges with other Societies, - - - - - - 350-357

List of Periodicals, - - - - - - - - - - 358-360

List of Members, - - - - - - - - - - 361-378

Index, - - - - - - - - - - - 379-383

PLATES.

PLATE — FACING PAGE

I.—Photography of Sound Waves. Figs. 1-6, - - - - - 80

II.—Photography of Sound Waves. Figs. 1-15, - - - - - "

III.—Plague. Fig. 1, Cervical bubo, - - - - - - - 170
Fig. 2, Margin of bronchial gland, - - - - - "

IV.—Plague. Fig. 3, Bacillus pestis from spleen of infected mouse, - "
Fig. 4, Bacillus pestis from inguinal bubo, - - "
Fig. 5, Bacillus pestis and pneumococcus from bubo, - "

V.—Plague. Fig. 6, Section of lung showing an area of air vesicles which are occupied by dense masses of bacillus pestis, - - - - - - "
Fig. 7, Section of kidney showing a portion of the cortex in which bacillus pestis has developed between the tubules in great masses, - - "

VI.—Plague. Figs. 8 and 9, Bacillus pestis, - - - - - - "
Fig. 10, Bacillus pestis in chains. - - - - - "

ERRATA.

Page 270, line 35.—Elide comma after metre.
″ 275, ″ 25.—For cobber read cobbler.
″ 277, ″ 21.—For *Wolfsungs* read *Wolsungs*.
″ 277, ″ 34.—The second **s**a-ek **a** is wrong font.
″ 284, foot-note.—For *Metricae* read *Metricæ*.

PROCEEDINGS
OF THE
ROYAL PHILOSOPHICAL SOCIETY
OF GLASGOW.

SESSION 1901-1902.

I.—*The Evolution of Solar Stars.* By PROFESSOR ARTHUR SCHUSTER, F.R.S.

[Read before the Society, 6th November, 1901.]

THE contemplation of our solar system, in which a number of planets move round the sun in the same direction, and nearly the same plane, gave rise to the idea that our sun has gradually condensed from a nebulous mass. This idea was confirmed by the discoveries of the telescope, which enabled men to see nebulous masses suspended in the sky, some spread out irregularly, some in spiral forms with denser portions, and some of globular shape, with a starlike nucleus in the centre. It was clearly a tempting subject to astronomers and others, to speculate on the gradual formation of the stars out of the original nebulous chaos. No wonder then that the interest, which had been aroused by Kant and Laplace, when they formed their celebrated Nebular Hypothesis, has been growing steadily, especially since the spectroscope gave us the means of studying the material out of which the stars are formed.

Everyone is now familiar with the main facts on which the science of spectroscopy is based. The radiations of a body, some of which when the body is sufficiently hot produce the sensation of light, differ for different substances, provided these are in the state of a gas. The molecule of the substance sends out trains of waves, every molecule or atom being capable of sending out a number of such, each differing in length from the other. The optical arrangement of our instruments causes each set of waves to produce a luminous line, and we therefore speak of the *lines* in the spectrum of a substance, meaning the waves which in our spectroscopes are collected together so as to form a luminous line. Each substance, therefore, in the form of a luminous vapour gives us a number of spectroscopic lines placed sometimes regularly, sometimes irregularly, and by the position of the lines we can recognise the nature of the substance. I shall have stated the fundamental facts of spectrum analysis if I add that a substance is always capable of absorbing those waves and those only, which it is capable of emitting.

In the sun and stars, we recognise the substances chiefly by their absorbing properties. There is a layer which may be liquid, or may even be gaseous (provided the gas be under a sufficient pressure), which gives us what is called a continuous spectrum, consisting of waves of no definite length, and in front of this layer the absorbing vapours must form a kind of atmosphere.

Let us now briefly review the facts which have led astronomers and spectroscoptists to the almost unanimous view that all stars are composed of essentially the same materials as are found in the sun, and our earth. The stars do not shew spectra which are identical, but the nature of the difference has led to the conclusion, that it is due to a more or less advanced condition of their state of condensation, and not to a difference in chemical constitution. The cause of the observed spectroscopic differences is therefore ascribed to the higher or lower temperature of their photospheres, and to the greater or less density of the vapours above the photosphere which absorb the light. To use a term which has become familiar and forms a good battle cry, it is said that the stars are in different stages of evolution.

The Jesuit Father Secchi, one of the pioneers of stellar spectroscopy, divided the stars into four types. The first type, which includes the majority of stars, is distinguished by the predominance of hydrogen. In the second type, to which our sun belongs, we have a great many metallic lines, and we can recognise the presence of nearly all the metals with which we are familiar on the earth. The third and fourth types, which together only include a small proportion of the total number of stars are feeble in luminosity and probably colder.

The subject I am dealing with is so large, that I am obliged to leave the last two types of stellar spectra out of consideration, but this does not affect the conclusions we may have to draw from the discussion of the two first types.

Since Secchi's time much has been done, and though his main division is still adhered to, we are obliged to subdivide his types. Stars have been discovered, which give intermediate spectra, so that we are now able to arrange them in a successive order, beginning with what are probably the hottest stars, and passing by small variations through the hydrogen to the solar stage and beyond. In the magnificent atlas of Stellar Spectra published by Sir William and Lady Huggins, we have in such stars as α Leonis, γ Lyrae, γ Andromedae, the now well known series of hydrogen absorption lines. These are strong and broad and strike the eye at once, but the spectrum also contains a number of fine and sharp metallic lines. Vega (α Lyrae) has a spectrum much resembling that of the other stars just named, but there is in addition a marked increase in the intensity of an important calcium line at the extreme violet end of the visible spectrum. This calcium line is one of a pair which always go together, but the other component is so close to one of the hydrogen series, that with the dispersion employed in stellar photography it cannot be distinguished from it. Still following Sir William and Lady Huggins' arrangement, we pass on from Vega, Sirius, and Castor to α Aquilae and Procyon, and find that in these the hydrogen lines gradually thin out, and the calcium line increases in strength. In Procyon the pair of calcium lines is predominant, the hydrogen line underlying the least refrangible of the pair being now overpowered by the calcium radiation. In γ Cygni the calcium pair is further strengthened, and we now obtain a spectrum in many ways resembling that of our sun; still there are some important differences, and a not unimportant gap has to be bridged until we come to Capella, which has a spectrum so closely resembling that of our sun, that when they are placed side by side, almost every line of the one seems to have a representative in the spectrum of the other. Still there are some decided differences. Arcturus is another star, the spectrum of which much resembles that of our sun. From the simple hydrogen spectrum of α Leonis we thus reach by small steps the complicated spectrum of the sun, with its multitude of lines due to iron, titanium, and other metals. Fraunhofer, the discoverer of these lines, designated the most important groups by means of letters; the two calcium lines already referred to being known as H and K.

The main facts, brought out by such a comparison as I have briefly indicated, suggest an organic relationship of these spectra, and a gradual evolution in the history of the star of the solar type of spectrum from the hydrogen type; but it remains to be explained why the ageing of a star should be accompanied by a thinning of the hydrogen lines, and their replacement, first by calcium, and then by the other metals.

I have not yet alluded to another important class of stars which is also marked by strong hydrogen lines, but which in addition shews other substances, and especially the newly discovered element helium, which sometimes seems accompanied by oxygen or nitrogen. These stars for reasons which I shall have to mention further on, are I believe unanimously considered to precede the hydrogen stars in the evolutionary series.

We may now define the problem before us in this way:—The stars fall as regards their spectra into a natural classification, which is quite independent of any preconceived ideas as to their origin. Does this mean that each star, or at any rate, the great majority of them pass through all the stages which we observe? Has for instance our sun at one time given a spectrum identical with that of *α* Leonis? Further, are we justified in concluding that all stars are made up of the same chemical elements in the same proportion. And lastly, admitting the gradual evolution, what is the meaning, as the star grows older, of the gradual displacement of the hydrogen in its atmosphere first by calcium, and ultimately by iron and other metals?

Before we enter into a fuller discussion of these points, I shall briefly review the methods of experimental investigation, which are at our disposal. The simple spectroscopic analysis, which only tells us of the presence of an element, is now complicated, but improved, by the observed fact, that spectra are found to vary according to the experimental conditions. If we volatilise a metal by a powerful spark, it sends out waves which are different from those which are seen with a weak spark, and if we replace the spark by the voltaic arc, which volatilises more material but is probably at a lower temperature, or by the oxy-hydrogen flame, distinct differences due to the different condition of the luminous vapour generally appear in the spectra. Opinions are not quite concordant as to the cause of these differences, how far they depend on temperature simply, and how far pressure and density may affect them; or whether, finally, the dissociating power of high electric tension may alone be sufficient to explain the observed facts. The metallic absorption in the solar spectrum seems roughly to correspond to that of our electric arc, while according to Sir Norman Lockyer, the metallic lines seen in the groups of stars intermediate between the helium and solar spectrum, correspond more closely to the spectra observed in our strongest spark discharges.

In addition to the changes which are produced by temperature and density, we have an effect due to pressure, which consists in a slight lengthening of the waves sent out by the molecules. This effect, which was discovered by Messrs. Mohler and Humphreys, allows us to determine that the pressure, to which the vapours in the sun are subjected, is somewhere between two and seven atmospheres.

The investigation of thermal radiation forms another avenue, through which we may approach the all important question of the surface temperature of the stars. It is only quite recently that Mr. E. F. Nichols has succeeded in comparing the total heat radiation of some of the brightest stars. Vega and Arcturus judged by the eye have the same magnitude, which means that the same amount of that radiation which affects our eyes reaches us from each of these two stars. But when measured by an instrument which is sensitive to all radiation, Arcturus is found to have more than double the intensity. As the proportion of total radiation to luminous radiation diminishes with rising temperature, this would indicate a lower temperature for Arcturus, and confirm the conclusion arrived at on other grounds, that the hydrogen stars have a higher surface temperature than the solar stars. Without actual measurements, we may derive the same result from an inspection of the ultra-violet region of the spectrum. This region is made up of rays which are too short to affect our retina, but which produce a photographic effect, and ought to be stronger and more extended, the higher the temperature of the radiating body. We find that in general the hydrogen stars are those which are richest in this ultra-violet light.

These different lines of argument, all leading to the same result, justify us in saying that the surface temperature of the hydrogen stars is higher than that of the solar stars. An extension of the same reasoning leads to the belief, that the helium stars have a temperature which is higher still.

The outward appearance and internal constitution of the stars is not solely defined by the temperature of their surface, and we are in some cases in possession of important information concerning their size, mass, and density. Some of the investigations which have been most fruitful in this direction are based on the fact that the waves of light sent out by the stars have a length, which in the quiescent ether through which they pass, and therefore also in our atmosphere, is slightly longer when the star is moving away from us, and slightly shorter when the star is moving towards us. This principle was first used by Sir William Huggins to determine the velocity of motion of a star, and has received many applications since.

It is easily seen that if a star were in rapid rotation, the lines of its spectrum should be blurred, but only in the case of α Cygni is there any probability that a visible effect is produced by such rotation. Were a star of the size of the sun, or smaller, to revolve round an axis which does not point towards the earth, and with sufficient velocity to be near the point at which, owing to centrifugal force it could throw off a planet or break up into two stars, we could not fail to notice it; but at present there seems little hope that we shall ever witness so interesting an event as the formation of a double star out of one rotating body. Yet there are several cases of double stars, where the two bodies must be nearly in contact with each other, and some of these must have been formed, not so very long ago, by the splitting up of a single rotating mass.

Passing on to the light thrown by theoretical investigations on the constitution of stars and other systems, I must notice in the first place those researches which refer to the internal state of gaseous masses condensing under the action of gravitational forces. A mass of gas sufficiently great to collect into a globular body, will be denser at the centre than near the surface, because the whole weight of the outer layer will cause pressure, and therefore increased density of the central portions. This increase of density will occur not, of course, by abrupt change, but will be gradual from the outside towards the centre. As regards the temperature we might suppose in the first place, that there is no difference throughout the mass, but even if this were the case at any one time, it could not long remain so. If the gas be warmer than the surrounding space, radiation will take place, accompanied necessarily by a lowering of temperature in some parts, and consequently the setting up of an ascending or descending movement. We call these movements "convection currents," because it is principally by means of them that heat is conveyed from one part of a gaseous mass to another. The winds of our atmosphere are convection currents, and the study of ascending or descending currents in the air, first suggested that important generalisation, which when applied to the sun and stars, led to our present views about their internal constitution. A mass of air rising against the action of gravity will expand and consequently cool, while descending currents will contract and become warmer. In a mass of gas like that of our atmosphere, ascending and descending currents of air are always taking place, and consequently the temperature within the gas will not be uniform, but will gradually diminish with increased altitude. This of course agrees with the observed facts, but the actual diminution of temperature as obtained by calculation, is on the average greater than the observed diminution. This discrepancy is to a great extent explained by the presence of aqueous vapour, for the ascending mass of air will soon become saturated, and the aqueous vapour will condense. This condensation will free the latent heat of steam and keep the temperature more nearly constant until all the vapour is condensed. Lord Kelvin, who was the first to investigate this problem, gave the name of "convective equilibrium" to the state of the air, in which the temperature is regulated by the expansion and contraction of ascending and descending currents.

If a star is a mass of gas in a state of convective equilibrium, its temperature cannot be the same everywhere, but must increase downwards just in the same manner as the pressure increases. The rate of increase depends to a great extent on the internal constitution of the molecules. At places where the gravitational attraction is the same, the increase of temperature with depth is proportional to the molecular weight multiplied by a number which is ·4 in the case of gases like mercury vapour, containing one atom in each molecule, and about ·3 in the case of gases which contain two atoms in a molecule. But as it is exceedingly likely that at the temperature of the stars, all molecules are monatomic like mercury vapour, we may base our calculations on that assumption. The investigations of Homer Lane, Ritter, and Lord Kelvin, allow us to solve the problem of the distribution of temperature and density within a star, assuming the interior to behave like a perfect gas in a state of convective equilibrium. Lane was the first to see the importance of a conclusion, which may appear paradoxical at first sight, but which is based on strict mathematical reasoning.

According to Lane, a star, while it radiates heat into space, does not cool, but actually becomes hotter, and this is due to the fact that the contraction, which accompanies the loss of heat, is accompanied by an evolution of heat which more than compensates for the loss. We may imagine radiation to take place chiefly from the outside, and there would no doubt be a lowering of temperature in these outer layers, if all convection currents were artificially stopped. But at the same time the contraction of the outer shell, enclosing the deeper layers would cause a rise in temperature in the inside, and consequently a disturbance of the thermal equilibrium. This could only be re-established by convection currents, which would supply the lost heat to the outer layers. Calculation shows that the temperature of the centre of a star increases in the same proportion as the diameter of the star diminishes; but it must be clearly understood that all these conclusions are based on the supposition that the whole mass of the star behaves like a perfect gas, a supposition which fails to be true at the surface of the star, and probably also near its centre.

If a star contained only perfect gases, its surface would be formed where the absolute zero of temperature is reached. But the metallic vapours which to a great extent compose the stars, condense into a liquid at a temperature of more than 1,000° above the absolute zero, and we must therefore imagine the boundary of the stars to be formed, not at the zero of temperature, but at the place where a cloud-like condensation of vapours takes place, the temperature of these clouds being probably somewhere between 4,000° and 20,000° C. This formation of clouds, though it precludes us from applying Lane's results to the atmospheres of stars which are below, say, 10,000° C., does not affect his calculations as to their internal constitution, which probably give us a good representation of the state of a star down to considerable depths. Ultimately, and especially in the case of stars which are already advanced in their condensation, the equations will fail, because when the molecules of a gas become as near to each other as they are in liquids, molecular forces come into play, which prevent the gases from behaving in the ideal manner of a perfect gas. The molecular forces diminish the compressibility, and ultimately the heat which is generated by compression will fail to compensate for the heat lost by radiation. When that period has been reached the star will begin to cool, pass into the liquid state, and soon cease to be luminous.

The questions, which meet us when we try to interpret stellar spectra, will be more easily understood after we have examined more closely what happens on the surface of the sun. We may, in the first place, enquire with advantage whether our knowledge of the constitution of that body supplies us any arguments for or against the theory of convective equilibrium, as presented to us by Lane and Ritter. I have calculated, chiefly from the data supplied by Ritter, the density, the pressure, and the temperature of the inside of a star having the same mass and size as the sun ; and behaving like a perfect gas in a state of convective equilibrium. The numbers are given in the accompanying table. A simple calculation allows us to extend the results to a period of time when the sun had a larger diameter. The first column of the table defines the position of the different layers in terms of the fraction obtained by dividing the distance of any layer from the centre, by the distance of the uppermost layer. The second column gives the density, and the third the pressure in megadynes per square centimetre, that unit being very nearly equal to our atmosphere. The last column shows the temperature, which depends however on the nature of the gas; the numbers given apply to hydrogen, assuming it to retain its biatomic constitution, and should in other cases be multiplied by the molecular weight. Thus assuming the whole of the inside of the sun to be made up of hydrogen split up into monatomic elements, the temperature at the centre would be 12 million degrees. If made up entirely of monatomic iron, the temperature would have 56 times that value. To apply the table to a previous period in which the diameter of the sun was, *e.g.*, twice as great, we should have to divide the second column by 8, which is the cube of 2, the third column by 16, which is the fourth power of two, and our third column by 2. It is a curious fact, which is not perhaps without signifiance, that the central density of the sun, as calculated on the assumption of its being a perfect gas, is only very little in excess of the density, which, according to the most careful recent estimate, is to be ascribed to the central portion of the earth, and again that that estimate is very little in excess of the density of solid iron.

GASEOUS SPHERE IN CONVECTIVE EQUILIBRIUM.

a = molecular weight compared to hydrogen.
R = radius of sphere.
= 700,000/B kilometres.
where B is a factor which is equal to unity in the case of the sun.
r = distance from centre.
$x = r/R$.
Mean density = 1·406.

x	B^3 × Density.	B^4 × Pressure in megadynes per square centimetre.	10^6 × a × Temperature/B.
0	8·44	8·65 × 1015	24·60
0·1	8·17	8·19	24·06
0·2	7·39	6·93	22·51
0·3	6·23	5·21	20·07
0·4	4·88	3·47	17·07
0·5	3·54	2.03	13·77
0·6	2·33	1·01	10·43
0·7	1·36	0·41	7·28
0·8	0·65	0·12	4·45
0·9	0·20	0·017	2·02
1·0	0·00	0·00	0·00

If it is allowable to imagine the sun to consist chiefly of iron vapour, that vapour when above the so-called critical temperature, might be expected to follow the laws of a gaseous compressibility until the density is nearly equal to that of liquid iron, and whatever the temperature, we shall not be able to compress gaseous iron to a density greater than that of solid iron. It is also allowable to conclude from this reasoning, that the distribution of density in the interior of the sun is not very much different from that indicated in the table, being probably rather less in the central portions, and hence rather greater in the outer portions of the solar mass.

Though the distribution of density and pressure in the interior of a star is probably fairly well represented by the table, the temperature almost certainly is considerably less through the greater portion of the mass. The failure of our equations in this respect is due to diminished compressibility, and also to our having left all effects of radiation and conduction of heat out of consideration. The effects of conduction will be most marked where, owing to increased density and diminished gravitational attraction, the convection current becomes less effective, as for instance near the centre of the star. The effects of radiation will be most marked near the surface, and especially in those portions of the star which lie above the cloudy condensations which we have considered to make up its surface. Gases like hydrogen will reach to some height above the surface, and form an atmosphere round the main body of the star. Were it allowable to neglect radiation altogether, these gases would be in convective equilibrium and rapidly diminish in temperature as they rise above the surface; they could not in fact rise much above the surface before they would be reduced to the zero of temperature. The fall in temperature with altitude above the surface of the sun is, according to calculation, $26 \times a$ degrees centigrade per kilometre, where a is as before the molecular weight. Thus for monatomic iron vapour the diminution in temperature would be 73,000° C. for each 100 kilometres.

It may not be unnecessary to say a few words as to the evidence we possess that the convection currents which play so important a part in the theoretical investigation actually exist in the sun. The surface radiates an amount of heat into space of which we can form a very fair estimate by measuring the quantity which reaches the earth. The number so obtained is 1,340 million per square metre of the solar surface, the unit of heat being the amount necessary to raise one gramme of water through one degree. We obtain an idea of what that number means if we imagine the sun to be surrounded by a shell of ice, the heat supplied by radiation could melt in each minute a layer of ice 58 feet thick. Or expressing it with Lord Kelvin in terms of power, we may say that the solar surface does work by radiation equivalent to 131,000 horse-power for each square metre of his surface. The heat thus lost by radiation must be supplied from the inside of the sun, otherwise the solar surface would cool down in a fraction of a second to a temperature at which it would cease to be luminous. If the heat is carried from the inside to the outside by convection alone, the velocity of the currents of vapour must be very great. Taking the pressure of the vapour near the surface to be one atmosphere, we may say that all the heat contained in a layer having a thickness of 370 metres is lost by radiation in each second of time, and this number does not depend on the nature of the vapour or on its temperature. A layer of that thickness would have to be replaced by convection in every second if the temperature of the surface is to be maintained. From this I calculate that if the difference in pressure between the descending and ascending currents is one atmosphere, the velocity of the convection currents must be 616 metres per second, or about 1,000 miles per hour. These up and down draughts of vapour must take place with the calculated velocity, unless an appreciable portion of the heat is supplied from the inside in some other way, as for instance, by radiation. It is difficult to form an estimate as to how far radiation can help to keep up the temperature of the surface. I have made some calculations on that point which, though they have yielded interesting results, cannot at present be expressed in definite numbers. It is sufficient for the present argument to maintain, that even if radiation takes a prominent part in the determination of the distribution of temperature, we cannot escape the conclusion that convection currents must bring about a continuous interchange of matter between the inside and outside of the sun. This theoretical conclusion is amply confirmed by observation.

The layer of luminous clouds from which the earth receives its light and heat is called the solar photosphere. Surrounding it is a layer of luminous gas, which is observed by means of absorption lines seen in the spectroscope, which indicate the nature of the substances composing it. This layer is known as the chromosphere, the shorter word having come into general use in place of the more correctly derived "chromatosphere." Not only are the gases of the chromosphere in constant motion, which is sometimes violent, but rising out from it, we have eruptions of luminous gases, called prominences, which reach to very great heights. In the solar eclipse, which was observed in the West Indies in the year 1896, one of these prominences reached to a distance of 140,000 miles. This is by no means the greatest height that has been observed, a prominence being photographed in 1895 by means of an ingenious method due to Professor Hale, which reached to a distance of 281,000 miles from the sun's limb. The rapidity with which these prominences appear to rise and change their appearance, is not perhaps a conclusive proof that the gases which they contain move with great velocity, for these gases are quite possibly always present, and the prominence may only be a sudden lighting up of the gas, or the rapid transmission of an effect, which does not actually require the transmission of a material body. But the tangential velocities observed at the limb of the sun within the chromosphere cannot be explained in any other way than by the actual motion of hydrogen and of the other gases which form the chromosphere.[1] This tangential motion is far more violent than anything which is required for the convection currents necessary to maintain the temperature of the solar surface. Professor C. A. Young, of the Princeton University, states that a velocity of a hundred miles a second is often exceeded, and that twice this velocity is occasionally reached. There can hardly be a doubt as to the facts, but their explanation seems to me more difficult than has been generally recognised. Professor Young says on this point ("The Sun," p. 207) :—"It would seem that thus we might explain how the upper surface of the hydrogen atmosphere is tormented by the uprush from below, and how gaseous masses thrown up from beneath should, in the prominences, present the appearances which have been described. Nor would it be strange if veritable explosions should occur in the quasi pipes or channels through which the vapours rise when, under the varying circumstances of pressure and temperature, the mingled gases reach their point of combination; explosions which should fairly account for such phenomena as those represented in Figs. 69 and 70, where clouds of hydrogen when thrown to an elevation of more than 200,000 miles with a velocity which must have exceeded, at first, 200 miles per second, and very probably taking into account the resistance of the solar atmosphere, may, as Mr. Proctor has shewn, have exceeded 500—a velocity sufficient to hurl a dense material entirely clear of the sun's attraction, and send it out into space, never to return."

My doubt as to the correctness of the above explanation is based on the fact that the highest velocity that a gas can reach when forced to move by differences of pressure is equal to the velocity of sound in the gas, where, of course, the temperature of the gas has to be taken into account in calculating the speed of sound waves. In order that a velocity of 100 miles a second may be possible in monatomic hydrogen, it is necessary that the temperature of the gas should be more than two million degrees, for in no other way can the velocity of sound in hydrogen reach so high a value.[1] On the other hand, if at a temperature of 10,000 degrees C., at which we may imagine the solar surface to be, a gas can rush out under the action of a pressure, however great, with a speed of 100 miles a second, the mass of its molecules must be over 200 times less than the mass of the hydrogen atom such as we know it. Sir Norman Lockyer has recently expressed the opinion[2] that the true spectrum of hydrogen such as is seen in the prominences is due not to the hydrogen atom as we know it, but to a much smaller one, derived from it by dissociation, and he has estimated this smaller atom to have a mass about sixty times smaller than the hydrogen atom. If this view were accepted, the difficulty would disappear, and the observed high velocities might be explained by internal pressure. But there is a difficulty in believing such small masses to be capable of emitting visible radiations.

---

[1] Since the above was written, another explanation has been put forward by Prof. Julius of Utrecht, who suggests that the shift of the lines may be due to anomalous dispersion.

Leaving for the present the possibility of such a great subdivision of atoms out of account, there are, to my mind, only three courses open to us. We may, in the first place, deny the necessity of admitting the existence of velocities as great as those I have named. As regards radial motion outward from the sun, the evidence in favour of the reality of these velocities is not perhaps conclusive. But the tangential velocities at the limb of the sun, which are velocities parallel to the solar surface, have been observed to be as great as the radial velocities and these must be real unless some other cause may produce displacements of spectroscopic lines. One such cause recently discovered, and already mentioned, is pressure, which increases the wave length. Other effects might be thought of, which may act in the same direction, but it is much more difficult to imagine any cause which can produce a *shortening* of wave length. As far as I can judge from the published accounts and drawings, a great tangential velocity at the sun's limb is as often observed to take place *towards* us as *away* from us ; hence, even if two causes may act, one shortening and the other lengthening the waves, it does not seem probable that the two causes would act with equal frequency and to an equal extent in both directions. For the present we are forced to admit only known effects, and hence we are forced to recognise the reality of the great velocities which have been deduced from the observations.

---

[1] The velocity of sound may for violent disturbances be greater than that calculated by the ordinary formula, but there is reason to believe that the calculated velocity cannot be exceeded many times.

[2] "Inorganic Evolution," page 182.

Various attempts have been made to account for a number of phenomena which are observed on the solar surface by electrical actions, such attempts being based on the supposition that the sun as a whole is a highly charged electrified body. But we know that no body at the temperature of the solar surface could permanently retain an electric charge. If there is therefore a permanent electric force, there must also be a permanent electromotive force tending to drive negative electricity from the inside to the outside, or *vice versa.* There is nothing improbable in such a supposition, as the phenomena of atmospheric electricity shew. The surface of the earth is charged with negative electricity, and though we know that every burning fire, and every wave of the sea breaking into spray, tends to dissipate that charge, it yet is permanent, and remains without apparent diminution. We conclude that some cause, upon which meteorologists and physicists are not yet agreed, exists, which tends to bring the dissipated electricity back to the earth, and we are confirmed in this conclusion by the fact that falling drops of rain are more frequently charged negatively than positively.

We are therefore quite at liberty to admit a high charge of electricity at the surface of the sun, which probably does not however exert any electric force, except near its surface; the outside being screened by opposite electrification. The only way which occurs to me as possibly causing an appreciable electric force at a distance greater than the solar diameter, would be to suppose the existence of highly eccentric meteoric swarms, which, passing near the sun, would carry the neutralising charge out into space. The streamers of the solar corona might be due to electric discharges between such retreating swarms and the sun.

If the sun is a highly charged electrified body, velocities like those observed in the atmosphere are possible, if these velocities are radial, *i.e.*, from the centre of the sun or towards it, but I am unable to satisfy myself that the observed tangential velocities can be explained by electric action. There only remains one way of accounting for these velocities, and that is to conclude that they are either directly due to meteoric matter circulating round the sun, or indirectly to meteoric matter falling into the sun, and locally generating a temperature sufficiently high to allow of molecular velocities of 200 miles per second. The velocity of a piece of matter circulating round the sun and close to its surface in a circular orbit is about 270 miles per second. Such a piece of matter would tend to carry with it the very tenuous gases which are floating above the solar surface, and may well impart to them a velocity ranging from 100 to 200 miles. If actually falling into the sun, the conversion of their motion into heat would be sufficient to account for the observed velocities.

The explanation of the violent disturbances which are observed to take place on the solar surface does not come within the range of my main subject, but it was necessary to point out that the convection currents, which form the foundation of the view, taken by the majority of astronomers, as to the internal constitution of stars, are actually observed to take place on the surface of the sun with greater violence than we might *a priori* have expected. A detailed study of solar phenomenon, is in my opinion the only sure guide in our investigations on stellar constitution, and it is probable that many of the unsolved problems, which still meet us in the interpretation of stellar spectra, will be cleared up in the solar and terrestrial laboratories rather than by mere statistical comparsions and classifications. There are in fact many similarities between solar and stellar phenomena. One of the most curious facts revealed by the photographs of star spectra is, as has already been pointed out, the peculiar behaviour of calcium which forms the main connecting link between hydrogen and metallic stars; and this behaviour of calcium shews itself with equal persistency in the spectra of solar prominences, which as regards the hydrogen lines, do not present a spectrum far different from that of α Aquilae or Procyon; while the similarity between the spectrum of the chromosphere and that of some of the stars has been pointed out by Sir Norman Lockyer.

Before leaving the subject of the sun, I may refer briefly to an argument which seems to me to be fatal to any theory which involves the decomposition of the elements right through its mass. We may say with certainty that no amount of pressure will increase the density of any substance much beyond what it is in its liquid state. Liquid hydrogen has a density of about 0.09 or less than the 15th part of the average density of the sun. I conclude that the interior of the sun cannot be made up of hydrogen or of any substance which might be formed by the breaking up of hydrogen, for such decompositions are as far as we can judge never accompanied by an increase of density.

On the other hand the mean density of the sun is quite consistent with the supposition that its interior is mainly composed of the same substances as are known to us on the earth.

We may now return to the main subject of our enquiry, which is the critical discussion of the arguments that have convinced the great majority of astronomers of a process of evolution, which in the course of time makes each star pass successively through a number of stages, in which the spectrum changes from that of the helium stars to that of the hydrogen stars, and hence to that of stars with prominent calcium lines and of the solar stars.

The first fact which requires explanation is the one, which is generally, though not universally admitted, that the temperature of the photosphere of the stars diminishes in the order in which they have just been named. If the hydrogen star is always hotter than the solar star, this would suggest that the chemical composition stands in some direct causal relationship to the temperature. Is the photosphere of α Leonis hotter because it is surrounded by an atmosphere chiefly containing hydrogen, or does α Leonis only shew us the hydrogen spectrum because its atmosphere is too hot to shew anything else? The discussion of this point is altogether independent of our ideas regarding evolution. Even if we do not wish to enter at all into the previous history of a star or its future development, we are bound to search for an explanation of the constitution of the present universe, which shews us hydrogen stars and solar stars, the former being apparently hotter than the latter.

But if we take the theory of evolution into account we have further to explain the fact that if the above be true, a star cools as it grows older, while the theory of Homer Lane, of which an outline has been given, states that the star should get hotter. The apparent disagreement between theory and observation has been a stumbling block to astronomers, but it is due in great measure to the want of definition in our meaning, when we speak of the "temperature" of a star. We do not observe the temperature of the centre, or the temperature of the gaseous mass below the photosphere, and it is with this temperature that the theoretical analysis deals. What we can observe is the photosphere and the absorbing layer above it, and the temperature of these portions of the sun are not touched by Lane's theory. If our ideas of the photosphere are correct, and it consists of condensed clouds of metallic or carbon vapour, the temperature of these clouds will be quite independent of the temperature inside the star: and for all we know, might under certain circumstances remain the same for a long period of a star's life, during which time the star may condense to a fraction of its original volume, and its interior become hotter and hotter, until the condensation has reached the point at which the laws of gaseous compression no longer hold. The surface of a star is pouring out energy in the form of radiation, and the temperature of the surface will depend on the balance of a number of delicately poised conditions. Equilibrium is reached, when the loss of heat by radiation is balanced by an equal gain of the heat from the inside or from the outside. The gain in the case of our sun is in great part due to the convection currents from beneath, which keep the photosphere at the temperature at which, under the existing pressure, the metallic vapours condense. So far we should expect the photosphere to become more luminous as the star contracts, because the greater the intensity of gravitational attraction, the more active the convection currents may be expected to be. But two factors may operate in the opposite direction. In the first place we must not assume that the inflow of outside meteoric matter, which not so long ago was considered to be the chief cause of the maintenance of solar heat, is altogether inactive. Even in the case of the sun, it has already been pointed out that several phenomena point directly to the generation of heat at the surface of the sun by the impact of falling masses. What in the sun is a subordinate cause may in some of the stars become predominant, and the photosphere may recuperate itself for the loss of energy which it radiates into space, not only from the inside but also from the outside. If this is the case we need not be surprised that the temperature of the photosphere is apparently higher in the younger stars, nor that the spectrum of these younger stars resembles that of the solar prominences.

But even without having recourse to outside influence, it is possible to account for the higher temperature of the hydrogen stars in a more direct way, by making the hydrogen atmosphere itself responsible for it. The temperature of the photosphere must be largely affected by the absorbing properties of the gases surrounding it. If, for instance, these gases were largely to absorb the infra-red radiation, the effect of such absorption would be observed in a rise of temperature. We need only point, in illustration of this, to the way in which the glass roof and sides of a hot-house protects the plants inside against loss of heat by radiation into space. If it were possible to imagine hydrogen to absorb infra-red rays, this gas would, by stopping the loss of these rays, increase the visible, and especially the blue and violet radiations and the fact that the metallic-lines shewn by hydrogen stars are principally the high temperature lines, would thus be accounted for. Such an explanation will only remain a mere surmise, unless it is confirmed by independent evidence, but perhaps the phenomena accompanying the formation of faculae on the sun may be found to furnish such evidence, although only of an indirect character. The faculae are bright streaks on the solar surface specially seen in the neighbourhood of spots, and according to recent observations, they are closely connected with the prominences which seem chiefly to lie above them. If the suggested explanation for the high temperature of hydrogen stars be correct, the same explanation would apply to any portion of the solar surface which has masses of hydrogen hanging over it, and the increased luminosity of those portions of the sun, which lie underneath the prominences, would be a necessary consequence. To prevent misunderstanding, it is well to point out that the infra-red absorption need not be due to the same molecules of hydrogen which give the well-known hydrogen spectrum, and which are almost certainly not identical with the diatomic hydrogen molecule which we prepare in our laboratory. The luminous hydrogen in the stars must be surrounded by cooler hydrogen, and the space surrounding the prominences will similarly contain masses of cool hydrogen, having radiating and absorbing properties differing from those of the luminous substance. If I have dwelt on an explanation which at present is little more than a guess, it is only to emphasize that we need not hesitate on theoretical grounds to accept the evidence of observation, that the photosphere of the hydrogen stars is hotter than the photosphere of a star giving a solar spectrum. The suggestions I have put forward are sufficient to show that the temperature of the photosphere is regulated by considerations which lie altogether outside the calculations of Lane.

We are now prepared to assert that the hydrogen star is hotter than the solar star, and that if there has been a process of evolution, this hydrogen period of a star is earlier than the solar period. The reason for this second statement will appear more clearly further on. This brings us to the next stage of our problem.

Why does the hydrogen disappear in the process of cooling, and why is its spectrum replaced by that of the metallic vapours. The simplest explanation—simple because it cuts the Gordian knot—is that offered by Sir Norman Lockyer. If the hottest star shews no metallic lines, it is because the temperature is too high for the existence of the molecule, which alone can emit the radiation corresponding to these lines. The atoms are decomposed or dissociated, or whatever name we may attach to what must practically be a splitting of what is generally considered an "atom," or in other words, unsplittable by chemical agencies. When a star cools, and its photosphere has reached the temperature at which the more complex molecule can exist, the corpuscles, according to Lockyer's theory will recombine and ultimately form metallic vapours such as we know them on the earth. This explanation involves an hypothesis that is possible and consistent, but which, before it can be generally accepted, must either be shown to be the only hypothesis consistent with the facts, or to be supported by strong outside evidence. A great difficulty of the dissociation hypothesis lies in the fact, that as in the case of the sun, so also in the case of the Algol variables of which the density is approximately known, that density is greater than the density of solid hydrogen, although these stars have spectra which are generally of the hydrogen or calcium type. In order to maintain the theory it would be necessary to imagine that dissociation only takes place on the surface of the star, and that the pressure inside is sufficient to produce recombination, in spite of the higher temperature which reigns there.

What are the alternative suggestions which have been made? Sir William Huggins, who touched on this in his Presidential address delivered to the British Association at Cardiff, draws attention to the effect of convection currents in mixing up different layers of the gaseous matter forming the star. If convection currents could be completely stopped, the heavier gases would sink to lower levels, and the outer layer of a star would be made up of hydrogen and the lighter metallic vapours. It is owing to convection that a mixing takes place, and the stronger the convection the more complete is this mixing. The following quotation will shew the position Sir William Huggins takes up in this matter:

"Now the conditions of the radiating photosphere and those of the gases above it, on which the character of the spectrum of a star depends, will be determined, not alone by temperature, but also by the force of gravity in these regions; this force will be fixed by the star's mass and its stage of condensation, and will become greater as the star continues to condense.

"In the case of the sun the force of gravity has already become so great at the surface that the decrease of the density of the gases must be extremely rapid, passing in the space of a few miles from the atmospheric pressure to a density infinitesimally small; consequently the temperature-gradient at the surface, if determined solely by expansion, must be extremely rapid. The gases here, however, are exposed to the fierce radiation of the sun, and unless wholly transparent would take up heat, especially if any solid or liquid particles were present from condensation or convection currents.

"From these causes, within a very small extent of space at the surface of the sun, all bodies with which we are acquainted should fall to a condition in which the extremely tenuous gas could no longer give a visible spectrum.

. . . .

"Passing backward in the star's life, we should find a gradual weakening of gravity at the surface, a reduction of the temperature-gradient as far as it was determined by expansion, and convection currents of less violence producing less interference with the proportional quantities of gases due to their vapour densities, while the effects of eruptions would be more extensive.

"At last we might come to a state of things in which, if the star were hot enough, only hydrogen might be sufficiently cool relatively to the radiation behind to produce a strong absorption. The lower vapours would be protected, and might continue to be relatively too hot for their lines to appear very dark upon the continuous spectrum; besides, their lines might be possibly to some extent effaced by the coming in under such conditions in the vapours themselves of a continuous spectrum.

"In such a star the light radiated towards the upper part of the atmosphere may have come from portions lower down of the atmosphere itself, or at least from parts not greatly hotter. There may be no such great difference of temperature of the low and less low portions of the star's atmosphere as to make the darkening effect of absorption of the protected metallic vapours to prevail over the illuminating effect of their emission."

In a discussion before the Royal Society in 1897 I took up an essentially similar position (Pro. Roy. Soc., Vol. LXI. p. 209).

"The chief difference (I then wrote) between a hydrogen and a solar star lies in the more or less effectual mixing up of the constituents. If we could introduce a stirrer into α Lyrae there can be no doubt whatever that the low-temperature lines of iron would make their appearance, while, on the other hand, if we could stop all convection currents on the surface of the sun, the hydrogen which now lies under the photosphere would gradually diffuse out and give greater prominence to its characteristic absorption."

I still believe this statement to be true, but I have modified my opinion in so far, as I do not now believe that the difference in the condition of the surface of stars like Sirius or our Sun to be sufficient to eliminate convection almost entirely in one case and make it the predominant factor in the other. The mean density of Sirius is probably not greater than that which our sun had when its diameter was about five times as great as it is now. But even then with a gravitational force still greater than that on the surface of the earth, convection currents must have been active in stirring up and mixing the strata down to a considerable depth below the surface. The conditions which I imagined, in 1897, to hold in the hydrogen stars, are not, according to my present opinion, consistent with the formation of a photosphere, which, I now believe, necessarily involves effective convection currents. Hence, there must be some other cause for the elimination of hydrogen out of the atmosphere of stars, when they have reached the solar stage. We are reasoning, of course on the supposition that the difference in the type of spectra is not due to any inherent chemical difference in the composition of the stars. The evidence for this assumption will have to be further examined, especially in view of the fact that if my suggestion should prove to have a solid foundation, and if the presence of masses of hydrogen is the cause and not the result of the higher temperatures of the photosphere, the difficulty we are now trying to overcome disappears. Here, as in the previous discussion, it is not so much my intention to argue in favour of one hypothesis or another, but rather to shew the different possibilities which may, in a natural way, account for much that is obscure at present.

If we had only to account for those stars which chiefly shew hydrogen and calcium we might attribute their spectra to the action, in an exaggerated form, of the same cause which produces the prominence spectrum of our sun. And if we consider that the influx of meteoric matter is directly or indirectly responsible for the prominences, we should be led to suppose that the stars of the Procyon type are bodies, in which the aggregation of meteoric masses from outside still plays an important part in regulating the temperature and spectrum of the superficial layers. This, though in many ways a satisfactory explanation, does not account for the spectra in which hydrogen is seen without the calcium, nor for other types of spectra which are generally considered to precede the Procyon type.

But the disappearance of hydrogen as the star condenses is not perhaps a phenomenon which should surprise us so much. Hydrogen is readily absorbed by many metals, even at a high temperature, and it is highly probable that gases shew phenomena of molecular absorption like solids or liquids, when they are subjected to a pressure so high, that their density approaches the density of the liquid state. I can see nothing improbable in the supposition that when a star condenses, and its pressure reaches a high value in the interior, it should begin to absorb hydrogen, helium, and possibly oxygen, nitrogen, and the other constituents which have either not been observed in the sun, or only give faint evidence of their presence. If this opinion is correct, a quantity of matter, suddenly transported from the interior of the sun to the outside, would violently give up the hydrogen which it was able to contain under its original pressure. The phenomena observed on the surface of the sun would seem to lend countenance to such a view, at any rate they do not contradict it. Another and, perhaps, simpler explanation is suggested by considering the process of the formation of a star from its first beginnings. Its consideration may therefore be deferred, until we are prepared to look at the question of evolution as a whole. I repeat that it is only my intention to put forward suggestions, which may be found to have some truth in them, and which should, therefore, be taken into consideration.

But from such speculative enquiries we may once more turn to the more solid search for further facts. Results which have an important bearing on our subject have been obtained from the observation of double stars, for they allow us to obtain a value for the state of condensation of the matter composing some of these stars. Professor C. E. Pickering and, later, Mr Monck have deduced a remarkable equation, which connects together the intrinsic bright ness of a star's surface, its mean density, and other quantities which may be obtained by observation. We may thus calculate the density on the supposition that all stars emit an equal amount of light per unit surface. As regards stars showing a similar type of spectrum, this supposition is probably nearly correct, but the results have to be used with caution when comparing a hydrogen and a solar star, for the mere fact that the spectrum of the latter is filled with absorption lines would induce us to believe—quite apart from any question as to the temperature of the surface—that the light leaving the star is smaller per unit surface of emission in the case of the stars giving a solar spectrum, as compared with those which only shew hydrogen lines. The result of calculation shows that on the average the density of the solar stars is 15 times greater than the density of the hydrogen stars; but this number was found on information which, as regards the nature of the spectrum emitted, was, in many cases, deficient. Pending a renewed enquiry into this important subject, I am struck by the slight systematic difference shown between the stars of different spectroscopic types. A density 15 times as great means, for the same mass, a diameter reduced in the value of 2½ to 1, and even this difference would disappear if the hydrogen stars had an emissive power six times as great as that of the sun.

The differences of density shewn by individual stars of the same spectral type are considerably greater. Thus γ Leonis gives a spectrum almost identical with that of Arcturus, which is generally considered to belong to a later period than the solar stage; its density on the assumption of equal emissive powers is ·0002 as compared with that of the sun. It is not possible to admit an emissive power 300 times as great as that of the sun, and hence the density of γ Leonis must be very considerably less than that of the sun. As far as the observations go, the stars which are purely hydrogen stars show smaller variations in density than the solar stars, and have a density which is unmistakably smaller, but great variations are found in the intermediate stages in which the calcium lines are prominent. γ Cassiopeia, for instance, has a density almost equal to that of the sun, being the third in order of density of all known stars, while γ Virginis, giving a similar spectrum, has a density sixty times smaller. The difficulty which, in the case of the binaries we have just discussed, arises from our ignorance of the intrinsic brightness of their surface, is overcome in the case of another set of close double stars, the so-called Algol variables. These binaries are characterised by the fact that they consist of two stars of unequal brightness, one of which passes periodically in front of the other so as to produce a variation in the combined brightness of the stars. But I must resist the temptation of entering into a detailed description of the peculiarities of these interesting stars, and content myself by referring to the conclusions of A. W. Roberts and H. N. Russell, which have given an average density considerably less than that of the sun. Thus Roberts finds for the mean of four of these variables ·18 for the greatest density consistent with the observations, while the corresponding density found by Russell for the average of 17 variables is ·20, closely agreeing with the former result. This means a density equal to about one eighth of the solar density. For the fainter component of S. Velorum, the greatest possible density is only ·03 as compared with the sun. The spectra of these stars all seem to belong to the pre-solar type, and their low density therefore confirms the results arrived at from the consideration of other binaries, though we should not lose sight of the fact that the average density of the stars of the solar type seems to be considerably less than that of the sun itself, so that the average density of the Algol variables is not much less than half the average density of the solar stars.

Interesting facts are brought to light when we investigate the distribution of types of spectra in different parts of the heavens. Such investigations are subject to the dangers accompanying all statistical enquiries, especially when the discussion must, to a great extent, turn on the differentiation between accidental and systematic deviations from the average. We owe a spectroscopic survey of the sky to Prof. E. Pickering, who, with instruments belonging to the Henry Draper Memorial Equipment, classified the spectra of 10,345 stars north of 25° of southern declination, and has since completed the investigation for stars which lie farther south. He has very fully discussed the results of the first of these surveys. Almost exactly half belong to the hydrogen type, 10 per cent. to the intermediate or calcium type, 12 per cent. to the solar type, and 25 per cent. to the Arcturus type. If we only take the stars which are brighter than magnitude 6·25, the hydrogen type includes relatively more, viz., 61 per cent., while only 5 per cent. belong to the solar type. The percentage of the Arcturian type is reduced to 18. If the region considered is divided into two equal portions, one lying as much as possible along the milky way, and the other away from it, it is found that of all the stars considered, the milky way shows a preference for the stars of the hydrogen type, 3,560 of these stars being mapped in the region of the milky way, and 1,658 away from it, the corresponding numbers for the calcium type are 650 and 430. Neither the solar stars nor those having a spectrum similar to that of Arcturus show, when their total number is considered, a preference for any particular part of the sky. Out of the total number of stars, 6,252 belonged to the portion of the sky which included, and 4,095 to that portion which did not include the milky way.

When we consider the distribution of stars of different magnitudes, we find that the hydrogen stars, which are of the fourth magnitude and brighter, seem to be distributed pretty evenly all over the heavens, and that it is only the weaker stars which show this effect of clustering in the regions of the milky way. The brighter solar stars, on the other hand, seem to be relatively more frequent in the milky way than away from it, and the more even distribution shown by the solar and Arcturian stars seems rather due to the fact that the stars of smaller magnitudes belonging to these types are chiefly found in the regions which lie away from the milky way. Thus, taking the stars down to the sixth magnitude, we find for the numbers in the district of the milky way, and away from it, for the hydrogen stars to be 152 and 84, while for the Arcturian stars it is 453 and 341, in both cases an increased number in the milky way.

The results obtained by Dr Frank Maclean, who confined himself to stars above the 3.5 magnitude in both hemispheres, are not altogether in accordance with the above. Out of a total number of 276 stars, 30 per cent. only were found to belong to the hydrogen type, 17 per cent. to the Procyon or calcium type, while 31 per cent. were Arcturian or solar. An unusually large number, viz., 32 per cent., were classed as helium stars, and this leads to the supposition that a number of stars which figure in Pickering's list as hydrogen stars, belong really to the helium sub-division. These helium stars show a very decided tendency to cluster in the milky way, but the distribution of the other types is, according to Maclean, remarkably uniform. Thus, dividing the sky into two equal portions, the first of which includes the milky way, the numbers for the hydrogen type are 20 and 16, a very slight excess in favour of the milky way. For the calcium type the numbers are 21 and 27, and for the solar and Arcturian types combined, 45 and 40. The total number of stars of the hydrogen and calcium types is thus remarkably nearly equal to that of the solar and Arcturian types.

A promising line of enquiry has been entered upon by Mr W. H. I. Monck, who finds that the apparent proper motion of solar and Arcturian stars is considerably greater than that of the Sirian stars. Out of over 5,000 of the latter stars found in the Draper Catalogue, 225 are known to have a proper motion of not less than one tenth of a second per annum in one or other of the elements, this gives a percentage of less than 4·5. On the other hand, the percentage of solar and Arcturian stars having the same proper motion is 20 and 15 respectively. This points to the fact that the hydrogen stars are further away than the solar and Arcturian stars of equal magnitude, or that on the supposition of an equal distribution in space, and equal average real motion, the hydrogen stars are more luminous, a fact which is quite in agreement with our previous conclusions.

But a novel and unexpected result is the position of the Capellan or solar stars as being the nearest to us, while the Arcturian stars are intermediate between them and the hydrogen stars. Mr Monck concludes that the Arcturian stars are not cooled down Capellans, but we shall find that if the explanation I have suggested as to the higher temperature and greater luminosity of the hydrogen stars is correct, the apparently anomalous position of the Arcturian stars is readily explained.

I have intentionally confined myself to a detailed discussion of only two of Secchi's types of stars, but must now briefly refer to other celestial bodies, so that we may be able to obtain a general view of the evidence on which the theory of stellar evolution rests.

There are two kinds of nebulous bodies which may be distinguished by their spectra. One of them, of which the nebula in Orion may be taken as a specimen, shows us bright lines of hydrogen, of helium, and of some unknown substance, the second kind, of which the nebula in Andromeda is a conspicuous example, apparently give a continuous spectrum, which is weakened so much by spectroscopic dispersion that it is extremely difficult to form a definite judgment as to the nature of the light emitted. While Professor Scheiner believes that he has obtained by photography the absorption lines corresponding to the darkest groups of solar lines, the observations of Sir William and Lady Huggins seem to give very strong evidence of the presence of bright lines in the spectra of these bodies. It is to be hoped that the matter may soon be cleared up, as these nebulæ include all those of spiral form, in which local condensations occur suggesting a similarity to what we may suppose to be the origin of the formation of more compact celestial bodies. The gaseous nebulæ of the Orion kind are nearly all situated close to the milky way, while the nebulæ having the Andromeda character, show the opposite behaviour, and obviously avoid the plane of the Galaxy. Passing on to bodies which appear to be intermediate in character between stars and nebulæ, we also find them confined to the milky way. These bodies, as seen through a telescope, appear to be stars, but their light when resolved by the spectroscope shows bright lines, either alone or in conjunction with dark lines. Their distribution along the milky way is irregular, and they tend to cluster together in certain parts of it. These bright line stars vary to some extent in composition, they show as a rule the lines of hydrogen and some unknown lines. Helium appears in some, but not in all of them. There appears to be a gradual transition from these bright line stars to the helium stars, which also are chiefly found in the neighbourhood of the milky way, and many of which are grouped together, thus all the bright stars of Orion, except Betelgeuze, and most of the weaker stars are helium stars. The high temperature of these helium stars is testified by the presence of oxygen lines, first identified by Dr F. Maclean, the particular spectrum of oxygen which appears in them being only obtainable in terrestrial oxygen by very intense sparks. The oxygen lines which, for instance, are found in the solar spectrum undoubtedly belong to a more complex molecule, and a lower temperature. There is again, apparently, a continuous transition from the helium stars to the hydrogen, calcium, solar, and Arcturian stars which I have described. The remaining types of spectra belong to lower temperatures still, as in place of the metallic lines, or in addition to them, certain bands appear, which experiments show us invariably belong to lower temperatures than the lines of the same element. Secchi's type III. possesses bands, as to the identity of which there is no consensus of opinion. These stars also cluster in the milky way, and a majority of them have the peculiarity of being variable in intensity. The variations are of longer period than that of the Algol variables, and at the maximum the bright lines of hydrogen are seen in many cases.

Lockyer holds that the carbon bands appear as bright lines, and this view, as far as I am able to judge of the evidence, is probably correct.

Nothing is known as to the reason of the light variation, but amongst the causes which can produce the same effect at regularly recurring intervals, there is only one which we can at present apply to celestial bodies with any show of reason, and that is the orbital revolution of the bodies round each other, but this question lies beyond the range of our present discussion.

The bands shown by Secchi's fourth type of spectra have been identified, and belong to carbon. The stars showing these spectra are all weak, but over 200 are known. Duner, to whom we owe the first systematic investigation of these stars, has shown that they also congregate in the milky way, not only absolutely, but also relatively to the other stars. Mr T. E. Espin has further investigated and confirmed this point. Out of a total of 224, the region within ten degrees of the milky way includes 123 or more than half, while 74 per cent. lie within 20 degrees of it.

We can only form vague guesses as to the manner in which matter was originally spread through space and has gradually condensed, probably, though not necessarily, through an intermediate nebular stage into the numerous luminous spherical bodies which we observe at night. If an evolutionary process has been going on, which is similar for all stars, there is little doubt that from the bright line stars down to the solar stars, the order has been: (1) helium or Orion stars, (2) hydrogen or Sirian stars, (3) calcium or Procyon stars, (4) solar or Capellan stars. The Arcturian stars are placed by most observers after the solar stars, but as mentioned above, the researches of Monck seem to bring them to an earlier stage of evolution. Opinions are divided as to the proper place to assign to the stars of the third type. There is on the one hand no definite boundary line between them and the Arcturian stars, the transition being gradual, the evidence of an evolution from the second or solar to the third type is as strong as that which is generally recognised to indicate an evolutionary process from the Sirian to the solar type. On the other hand the fact that these stars are nearly all variable, that they probably contain bright lines, and that they aggregate in the milky way, lend force to Lockyer's contention that the stars are in an early state of formation, and that the low temperature of their absorbing layer indicates that it is still rising in temperature. The carbon stars of the fourth type have been uniformly placed at the end of the succession of spectroscopic changes, though according to many astronomers this last stage does not succeed the third type stage, but follows the solar stage. These authorities would either, like Lockyer, remove the third type into the early features of a star's history, or derive it independently from the solar stage. According to this latter view, stars having reached the solar stage would bifurcate, and, according to their chemical composition, develop either the spectrum of the third or that of the fourth type.

The views I have expressed, and suggestions I have made in the previous pages, have led me to the following succession of events, as being in harmony with observed facts.

We may start from matter distributed with approximate uniformity through space, and leave out of account the question whether that original matter was in the form of our present elements, or in some primordial state, out of which our elements have been formed. If the latter case, the conditions must have been such that in different portions of space this primordial matter would condense into our elements, nearly, though probably not absolutely, in the same relative quantities. The formation of the elements I assume to take place simultaneously with the condensation into larger conglomerations.

The first point I want to draw attention to, is that the effect of the first condensation must have been accompanied by a rejection of helium, hydrogen, and of other light gases, because the development of heat which accompanies the early agglomeration, and raises the temperature of the gaseous bodies, must through the known laws of expansion increase their volume. The gravitation towards the condensed portions of matter not being sufficient to retain the hydrogen, it will diffuse and tend to spread through the adjoining portions of space. In regions where there is no violent motion, it appears to me that matter will tend to concentrate itself round certain nuclei, which will begin to attract each other and clash together. A number of stars will then form, and these stars will at first not contain hydrogen or helium in appreciable quantities. These lighter gases will be left behind as nebulous masses, because it has been shewn that unless the gravitation towards the centre of a celestial body exceeds a certain value, light gases cannot form a permanent constituent of the atmosphere. This seems to be a not unlikely explanation of the gaseous nebulæ. These bodies are by observation found to be connected with stellar clusters, as has been shewn by the remarkable photographs of the nebulous regions surrounding the Pleiades, and the spectroscopic investigation of the great nebula of Orion.

As soon as a star has grown sufficiently to be capable of retaining the hydrogen and helium, atmospheres of these gases will form round the stars, and the temperature of the photosphere will rise to its maximum. A process of diffusion of hydrogen and helium into the star will at once begin, and may be helped by the process of absorption which has already been alluded to. The helium will be retained first, as it is denser than hydrogen, and we may therefore expect to find helium stars showing the hydrogen lines either weakly or not at all. As a star grows in size the hydrogen will be more and more condensed on its surface from the outside, and we may get a considerable atmosphere of that gas forming round the star. The helium which has first condensed will also first diffuse towards the inside, and we then get the typical hydrogen star. The process of diffusion of the hydrogen, helped quite probably by an absorption due to molecular action, will continue to go on until a stage of equilibrium is reached, in which there is some, but possibly very little, hydrogen near the surface of the star.

It may be objected that the above explanation leaves out of account the peculiar behaviour of calcium in the intermediate stage between the hydrogen and solar star. My answer is that the same objection applies to all other explanations. We must at present accept it as a fact that there is a peculiar connexion between some of the lines of calcium and the hydrogen line. This is shown by the phenomena which take place on the sun, as strongly as by those which take place in the stars. The connexion may be a chemical one, or may have a hitherto unsuspected origin. I have spoken of these lines which Fraunhofer designated by H and K as "calcium" lines, as so far we have only been able to obtain these lines, when there was ground for the supposition that calcium was present. At the same time I do not think many spectroscopists would be surprised, if it were found that these lines did not belong to the metal calcium at all. That was the opinion arrived at by Stas for reasons which to my mind are insufficient, but the opinion may ultimately turn out to be correct, even though for the moment experiment does not lend much countenance to it. At present therefore, we must content ourselves with accepting the peculiar behaviour of these lines and their connexion with hydrogen as an observed fact, but the acknowledged want of a sufficient explanation of the fact cannot be quoted as an objection to any particular view on the connexion between different types of spectra.

A word may also be said as to the peculiarity of helium, which does not shew its presence among the Fraunhofer lines, although it is known to be present in the sun, because its lines appear bright in the chromosphere. There are two causes which may prevent a line from being visible as an absorption line, the vibration which gives rise to the line may be too nearly homogeneous, or it may be too intense.

It has never to my knowledge been pointed out, though it is obviously true, that an absolutely homogeneous vibration can never give rise to an absorption line in instruments of finite resolving powers. That is a possible, though perhaps not very probable explanation of our failure to detect helium among the absorption lines. The second explanation is contrary to what is generally accepted as true, but only because writers are accustomed to consider the radiation from the solar photosphere to be the radiation of a perfectly black body. If the drops or liquid masses which form the photosphere have any power to reflect or scatter light, such as for instance we know rain drops to possess, the solar radiation need not, as regards intensity, exceed, say half that due to a black body of the same temperature. It would then become quite possible for a *cooler* body in front either not to show any absorption lines, or even to shew them as *bright* lines. The absence among the Fraunhofer lines of the high temperature radiations observed in the chromosphere, is probably due to this cause.

Returning now to the secular changes in the stars, I may point out the distinctive features of the views which I have suggested. These views, in the first instance open out the possibility of much greater variations in their life history than has generally been admitted. The amount of hydrogen a star is able to condense will, according to my present view, depend on its mass, and on the amount of hydrogen which happens to be present in the neighbourhood. Whatever there was originally may already have been drawn towards a previously formed and bigger star. Hence the possibility of a star forming and never passing through the hydrogen stage. Even when the star has as small a density as γ Leonis probably has, it may give the spectrum of a solar star, simply from the want of a hydrogen atmosphere. On the other hand there may be stars, which having attracted a large quantity of hydrogen, but being of comparatively small total mass and small size, are not able to absorb the gas completely, and may remain hydrogen stars without passing through the solar stage at all. Finally, the difference between the Arcturian and solar star may not be one of age at all, but of mass. If the Arcturian star is one which is bigger, it will be able to absorb the hydrogen more completely, and the final state of equilibrium will be such, that the hydrogen lines will be thinner than in the Capellan or solar star.

This seems a plausible explanation of the results of Mr Monck, who finds the Arcturian star to have a smaller proper motion than the solar stars. They are, if my views are true, brighter but cooler, because, their surface is larger, and hence, on the average, they are further away. The theory, if I may call it so, also gives an explanation of a very curious fact, which I venture to think has not so far been satisfactorily accounted for. In the case of dark stars, it is often found that the brighter one is yellow and gives a solar spectrum, while the smaller one is blue and gives a hydrogen spectrum. The larger one, though it may originally have attracted less hydrogen to itself, will be able to absorb it more rapidly, and then pass through the stages of spectroscopic evolution more quickly.

There is marked difference between this explanation and that advocated by Sir William Huggins, according to whom a star of small mass would run rapidly through the various stages of evolution. We both agree of course in the main fact, that a small mass would lose heat more rapidly, but according to the views here put forward, there is a counterbalancing tendency in the fact that a large mass would absorb the hydrogen more quickly, and therefore shew a more rapid tendency to pass from the state in which it gives a hydrogen spectrum to the state in which the metallic lines become prominent.

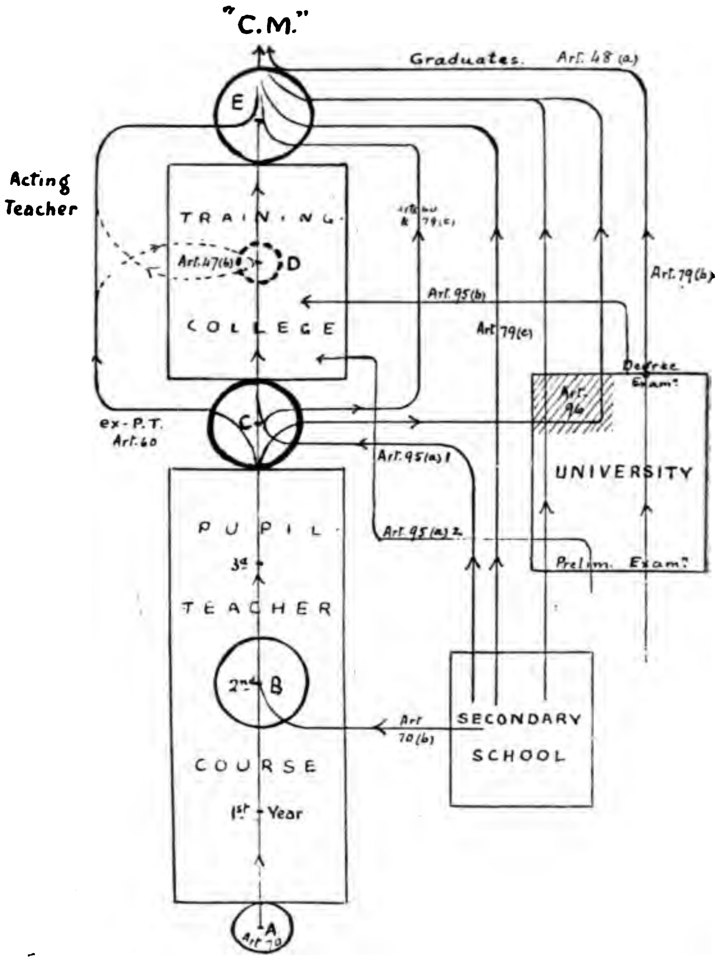
I will not discuss the question of the spectra of the third and fourth types, for the reason that we have not sufficient data to form any decided opinion about them. As regards the spectra of the third type, it has already been mentioned that opinions differ as to whether their position is anterior to the hydrogen or posterior to the solar star, and there are valid arguments on both sides. The carbon stars are really disconnected from the others, and though they may ultimately be found to have a place in a general system of classification, there is at present nothing to shew that they are not *sui generis* and the result of condensation in a space where carbonaceous matter happened to be abundant. It has already been mentioned that they seem to shew bright lines, and therefore probably belong to an early, rather than a late, stage of condensation. I know that the great principle of uniformity will be quoted against any supposition that a particular class of stars is essentially different in its composition from others, but I believe on the other hand that the skies bear ample evidence of real differences in composition. There is only need to mention, for instance, the dark bodies which by their passage in front of companion stars, produce the variation of light of the Algol variables. The obscuring stars have a density considerably less than that of water, and as their temperature is low, they must be composed of elements differing widely from those which make up the earth or the sun.

I cannot admit the validity of an argument based on the so-called law of uniformity, which has always proved a fallacious guide.

Examples are plentiful in the history of science where the law of uniformity might have been quoted, and has been quoted, in support of obsolete moribund theories. Thus the savage knowing that fire can be made by intelligent hands, unconsciously applied the law of uniformity to conclude that the lightning which set fire to the forests was caused by intelligent beings, surpassing him in grandeur as much as a lightning flash surpassed the feeble fire he could strike himself. When he saw the sun apparently moving in his orbit, he was compelled by the law of uniformity to conclude that an intelligent being must carry that body in a chariot. When the mediæval magician felt that everything in this world seemed created and centred round the human race, when, moreover, he saw the moon obviously describe an orbit round the earth, he could quote the law of uniformity against the Copernican doctrine, which needlessly removed the centre of the universe from what to him seemed its evident position. Even in more recent times false analogies, and conscious or unconscious appeals to the law of uniformity, have been constant sources of deception.

We are led by pure reasoning, and without any consideration of imaginary laws, to consider the universe to be in the state of a clockwork which is running down. We can form some idea, guided by our experience and observation, how a star may have formed and may pass through its various stages to extinction, but to say that all stars must necessarily pass through the same stages, to conclude that Sirius will ever look like Arcturus, is to put ourselves in the position of one who having discovered that there is a certain law which apparently connects the ages of children with their height, calls the law of uniformity to witness that a man who is five feet high is necessarily younger than one who measures six. If the law of uniformity had reigned at creation there could have been no life, for there can only be uniformity in death; but if there were sufficient diversity of position, of mixture, and composition, to allow of aggregations of matter culminating in the formation of worlds, we may be sure that we shall be able to trace that diversity in the present composition of the stellar system. The universe shews law, order, and regularity, but it refuses to be forced from birth to death through a single channel. There is uniformity no doubt, but it is a uniformity, which at all times, and in all places, is relieved by endless variety.

QUO VADIS, DOMIN(I)E?



II.—*The Training of Teachers in Scotland.* By JAMES KNIGHT, M.A., B.Sc., F.C.S., F.G.S., F.E.I.S.,

Head Master of St James's School, Glasgow.

[Read before the Society, 20th November, 1901.]

THE present paper deals with the training of teachers for the elementary and higher-grade schools of Scotland, and, although a great deal of what is said applies to the professional training of teachers anywhere, still the facts upon which the arguments are based are drawn from Scotland exclusively, and indeed at present the intimate connection between school, training-college, and university which has long existed here, is impossible in any other part of the United Kingdom.

Further, on the broad classification of Scottish education as university, secondary, and elementary, we find that only in the last case is systematic provision made for training teachers. Alike in the University and the Higher-class Public School, scholarship is demanded of the professors and teachers rather than professional skill, which latter has to be acquired by experimenting on the "vile bodies" of the students, with results familiar to us all. In a secondary school like our own High School, teachers are, usually, honours graduates, often former pupils of the school, and they enter upon their duties as assistant masters with a salary of £120 a year and upwards, to spend a year or two in learning their business. In justice it must be added that many of the teachers in these schools have received a professional training, and that the popular management of these Higher-class schools, which is almost universal in Scotland, has established a continuity between them and the primary schools under the same School Board.

Without dilating upon the immense political importance of having well-trained teachers, or the results, both moral and intellectual, which these teachers are bound to produce upon the future citizens of our country in their most plastic age, it will be sufficient to establish both the magnitude and importance of the problem by some trite statistics from the Blue-book of 1900, containing the annual report of the Scotch Education Department. In that report Sir Henry Craik reminds us that the elementary and state-aided schools in Scotland have on their roll over three-quarters of a million of scholars, one sixth of the total population of the country, and that these are taught by over 12,000 teachers, to say nothing of some 4,000 pupil teachers, 1,250 students, and over 2,000 as well as other "uncertificated" teachers, teachers in higher-grade, secondary, and private schools not so directly within the ken of the Department. These figures alone make it obvious that any defects in the training of teachers may, and in some cases must, react upon a very large section of the population, and they will serve as an apology for the present paper.

Our professional training has undergone a continuous degeneration, somewhat similar to that encountered in most of the learned professions, with the exception of medicine, which has shaken itself almost entirely free from the taint. Education and instruction have become confused, and in every case the line of least resistance has been followed, so easy is it to instruct so difficult to educate. Instead of aiming at genuine education, cultivation of faculty, bringing out of the man whatever of good there is in him, our whole course for the last quarter of a century has run along a line which is every year swerving more from the true path. Instruction has been interpreted only too literally to mean "piling it on," the memory has been exalted to a bad eminence among the mental faculties, and has paid dearly for the dubious honour; facts in language and literature, history and geography, arts and sciences, have been crammed in a style which would have delighted the heart of Thomas Gardgrind. In order to increase the possible quantity of assimilable material, this has in many cases been reduced to the form of a kind of intellectual pemmican, and even this is often peptonised and predigested, with the usual result, atrophy. Complaints have been made that teachers have not readily risen to the demands of the New Codes of 1899-1900, the most admirable educational systems this country has ever seen; it is complained that our teachers have lost what used to be considered a fundamental property of living matter, adaptability; but who made them wooden? wooden teachers are made, not born. In order to trace this evil to its root, a short summary is needed of the methods by which teachers have been supplied and trained under the Education Act of 1872.

Twenty-five years ago a boy or girl entered the teaching profession at the age of 13 as a pupil teacher on a five years' apprenticeship, and then proceeded to a Training College for two years more. Somewhat later the age of entry was raised to 14, and the apprenticeship shortened to four years, no change being made in the Training College course. Under this old regime the pupil teacher was generally selected by the schoolmaster from those scholars of his senior class who seemed likely to prove "lads o' pairts" for the work. Of course the parents were the legal guardians, and their names appeared as parties to the engagement, but parental action generally depended on the schoolmaster's advice, which in small country schools was often more than advice. Since these apprentices were intended to assist the master himself, it was his interest to look out capable pupils to begin with, and he had further the training of them in his own hand. They taught in their own school, with the curriculum and methods of which they were already fairly familiar; they taught there all day under the personal supervision of one who had known them for at least half-a-dozen years, and who was, therefore, ready to meet, encourage, or check any idiosyncrasies that were certain to appear. The pupil teachers were all taught together by the master, generally for an hour per day out of school hours, and such teaching lent itself in the most direct way to better practical work in the school-room. This was the system in vogue throughout the country up till ten years ago, and it is still the practice in small country schools. It produced men and women who were excellent *teachers*, apt to teach, if ever anybody was. On the side of scholarship it failed, for the pupil teachers simply reflected the scholarship of their master, and water cannot rise above the level of its source. When the master was highly educated his pupils were the same, and *per contra.* His education was generally on the narrow university lines of earlier days, and he was strong in Latin and mathematics, but weak in drawing and science. Still, many a teacher who was not a scholar himself took a pride in advancing his pupils beyond his own level, and in cities where the means abounded he would encourage them to attend special classes in the evenings to make up for their defective training in school.

In those early days a school curriculum comprised little except the three R's, and there was no temptation to widen one's culture at the expense of depth. While water cannot rise above its own source, engineers have ways and means of overcoming this natural defect by increase of pressure behind, or its diminution before, and I may, without suspicion of egotism, draw from my own experience to support this contention. Seven of us were chosen as pupil teachers in this old-fashioned way by a master who was above all a teacher and a trainer, and while his own scholarship was mediocre, he spared no pains to remedy that defect in his pupils. To take only two branches, Drawing and Science:—our headmaster was no draughtsman, but he engaged good men, and knew good work when he saw it, with this result that Cathcart Street School was on one occasion second in the list of the British Schools of Art, and of the seven pupil teachers who formed our set, all had their "D" or full drawing certificate before entering the training college, except one girl, who had only one subject to take, and the boys had in addition so thorough a training in mechanical drawing and chalk and colour work, that these recent demands in brush-drawing, free-arm drawing, design in colour, etc., have come to the survivors of us simply as the revival of pleasant memories.

Again, take Science. Our headmaster had not a single science certificate that ever we heard of, but he sent us to the old Andersonian, and even paid some of the fees, with the result that all of us were fully equipped for this other new subject of Nature-study, a quarter of a century before it appeared in the Code. Finally, on entering the training college, the same generous policy found ample justification in the published results. Out of the seven, one, the lowest, was eighth on the list of her college, one was fifth, three were third, two were first, and one headed the list for Scotland. I cannot conceive such things happening in these days of impersonal selection and factory training.

With the greater prominence given to drawing and "specific subjects," there came a demand for a wider curriculum. Further, the Education Act had caused a great rush into the teaching profession, and this was accentuated by the advent of the big School Boards in '76 or so, when the men who were on the spot floated in on the crest of the wave to salaries which were the envy of many a university professor. Boys rushed to become pupil teachers, and it was soon recognised that no better opening could be found for girls, so that the proportion of the sexes in the profession, at first almost balanced or, slightly in favour of men, gradually swung round as women took an increasing share in this work. At present women form three-fifths of the profession, and the fraction is yearly increasing, so that within a short time we may be in the position of the United States, where in certain districts teaching is entirely in the hands of women. And not merely in numbers is the disparity increasing, but in quality as well. At present the prospects for male teachers are so poor that no clever boy is attracted to the profession, and the men who enter the training colleges are in many cases second-rate, while so great is the rush of women, that many female candidates, who pass first-class in the entrance examinations, have to be shut out for want of room.

In consequence of this "boom," which began to be felt about 1878, admission to the training colleges became increasingly difficult, and various devices were invented to force an entrance. The colleges themselves opened a back door in the shape of a preparatory class, specially devoted to the work of the entrance examination, and many outsiders, who had no apprenticeship, studied at these classes, free from the handicap of daily teaching which hindered the genuine pupil teacher, and so gained admission. It is only fair to say that many pupil teachers who had failed to be admitted, went to these classes and succeeded the next time. It is true that the Education Department discouraged this back door by giving extra marks to those who had served an apprenticeship, but these marks could easily be overtaken by one who was devoting his whole time to study for one specific object, and who had not merely the fag end of his day to give after the worry of a day's teaching.

From this point dates the rise of the "ex-P.-T.", with her subsequent development into an "Acting Teacher." Managers and School Boards were not long in recognising that the term "trained teacher" was a technical and Departmental one, to be used only in a Pickwickian sense. They saw that the genuine professional training was got in the apprenticeship, and not in the so-called Training Colleges, and so they encouraged their girl pupil teachers, who had been refused admittance—often solely from want of room—to continue in their service as ex-pupil teachers. In this way the School Boards in question saved money, for an ex-pupil teacher cost only £30 to £40, against £60 or £70 paid in those days to a "trained" female teacher. The girls themselves reaped the benefit, for in most cases they would have had to pay fees in the training college, instead of receiving a salary, and in two years they could sit the exit examination of the college along with their more successful (?) sisters, and then rank with these as full-fledged certificated teachers. Indeed, such a course was easier, in spite of the day's work, since at the exit examination it was only a question of marks to be attained, not the narrower problem of vacancies to be filled, as at entrance.

With the advent of the larger School Boards, like that of Glasgow, there came the introduction of what may be called, without reproach, the factory system. The expense of procuring sites encouraged the building of huge schools, accommodating from 1,000 to 1,500 pupils, necessitating a large staff of teachers, and completely divorcing the headmaster from that personal knowledge, both of teachers and classes, which he could hardly fail to possess in a school of 500 or less. At first the instruction of the pupil teachers was committed to the assistants, one hour a day out of school hours, but these assistants had no personal relations with the pupil teachers whom they taught, one man might have all the pupil teachers of the third year, say, though not one of them taught in his own department, and so began that separation of instruction from professional training which has widened ever since. Any advantages in point of scholarship—and very often there was a loss—were discounted by the fact that these assistants were, as a rule, young men and women fresh from the "Normal," lacking in experience, and above all, in the "gumption" necessary to handle boys and girls between the critical ages of 14 and 18. Thus, up till 1878 teaching power had not increased, and scholarship was still so poor that the term "Normal student" was at the university a term of reproach.

In order to unify and systematise instruction, the School Boards of all the larger towns, except Edinburgh, have for the last ten years gathered all their pupil teachers into central classes. This made for economy, for one teacher could manage forty as easily as four, and it raised the standard of scholarship, since by degrees these classes came to be run on special lines, as in the higher class public schools and universities. Here, however, the separation of instruction from professional training became complete, the teachers of the central classes, or Pupil Teachers' Institute, have no knowledge of the school work of their students, and the head master of a school is likewise ignorant of the work of the Institute. With a continuous rise in the standard of examinations, more especially since the introduction of Leaving Certificates, the demands of the Institute have become more and more exacting. The pupil teachers are selected by open competition, altogether apart from professional ability, they are distributed among schools to which, in most cases, they are absolute strangers, they are in school only half a day, and have no personal interest in their classes, in very many cases they have never seen more than one department of their school, generally the infant room, in a word, their centre of gravity is no longer the school, but the Institute, and no one can blame them if they do at school as little work as they possibly can. On the other hand, certificated teachers, working in school, recognise that their pupil teachers are simply birds of passage, not responsible to an Inspector for the appearance of a class, and therefore they keep the class very much in their own hands, giving the pupil teacher only routine and drudgery work, such as correcting exercises, sharpening pencils, and the like, till the unfortunate apprentice comes to regard the school as a necessary nuisance.

This evil has been accentuated by recent provisions of the Code which permit pupil teachers to shorten their apprenticeship by gaining leaving certificates. Thus with three lower-grade certificates a pupil teacher may save two years, and with higher-grade certificates may save the whole time, entering the Training College or University without apprenticeship of any kind. If these certificates covered the field of knowledge essential to a teacher no harm would be done on the side of scholarship, though, of course, the failure in teaching power would still remain. But the Leaving Certificate Examinations were instituted in '88, not for teachers at all, but for the secondary schools, and more especially the Higher-class Public Schools, of which the Glasgow High School may be taken as a type. These schools are intended to lead up to the short degree course of a University, and the Leaving Certificate Examination proceeds on the same exclusive lines, with the single exception of Book-keeping and Commercial Arithmetic. The subjects of examination, in order of their preference by candidates, are English, Arithmetic, French, Mathematics, German, and Latin, the other subjects appealing only to comparatively small numbers, and not many of these within the teaching profession. The examination takes no account of subjects which are of prime importance to teachers, such as the sciences, theoretical and practical, drawing in its varied forms—

geometry, freehand, free-arm, black-board, colour-work and shading, design—manual instruction, hand and eye training, music and drill, all of which enter into the curriculum of every good elementary school. Even English, as examined for the Leaving Certificate, is not a suitable test for a teacher, the test in spelling, for example, is far too meagre, and the whole examination is run on the lines of literature and philology without reference to professional requirements. It is not suggested that these lines are wrong, for these examinations are not primarily intended for teachers, as already pointed out; unfortunately, however, the possession of a Leaving Certificate carries certain valued privileges, a shortened apprenticeship and direct entrance to a Training College or University, and so they become a temptation to sacrifice more technical or professional courses of instruction and thus widen the gulf which already exists between the instruction of a teacher and his professional training.

The system is already bearing evil fruit. Not only are the young men and women from the central classes securing all the available places in the Training Colleges and thus shutting out country pupil teachers who are much their superiors in professional skill, but their own professional attainments have fallen to a level unprecedentedly low. The testimony of H. M. Inspectors on this point is strong and unanimous, as the following quotations from the Report of the Scotch Education Department show.

Thus, Mr Scougal says (Blue-Book, 1899-1900, p. 475):—"It is becoming more and more evident that wherever the central class system of tuition of the pupil teacher is adopted, the important matter of his training in practical teaching and class management is one that calls for most serious consideration and for most carefully planned arrangements on the part of managers and headmasters."

Dr Stewart:—(p. 518). "While the central system of training pupil teachers has greatly improved the intellectual side of their education—a desirable end promoted also by the Leaving Certificate—it is to be feared that there has been a loss in the practical work of teaching."

Dr Smith:—(p. 520). "The pupil teacher question has always been a difficult one, and it is becoming more so. This is due to the antagonism between the duties and the interests of the pupil teachers. Their interests, as represented by their chances of obtaining an entrance into the training colleges, require that they be instructed in a more thorough way than of old. This has necessitated in many cases the institution of pupil teachers' classes in the central schools of the parish. Many of those taught at such classes have obtained high Leaving Certificates; but their success has been obtained at the cost of their duties in their own schools. Headmasters have frequently informed me that on some days of the week they have no pupil teachers, and on others only two or three. No school can be conducted satisfactorily under such conditions."

Mr Walker:—(p. 559). "It does not at all follow that the man who knows most can teach best, . . . but it does follow that, if a man can teach, the more he knows the better. Country pupil teachers, with their limited facilities for instruction, are at a great disadvantage as compared with those in large towns who can attend central classes. They have, however, the decided advantage of seeing how the work of a school is carried on as a whole, and of being able to put their hand to any part of it; whereas the town pupil teacher may have to do with only one class or part of a class—very inadequate preparation for the charge of a school in which all classes and subjects have to be taught single-handed. If the country teacher be a man of character and energy, as most of them happily are, the pupil teacher cannot fail to benefit more by his daily contact with him than if he were one of a large class at a central school."

In view of these remarks by the Chief Inspector for the Northern Division one cannot but deplore the fact that these good teachers are being ousted by the well-informed but badly trained products of the factory system. Similar strictures run throughout the Report; it is sufficient to quote one by Mr Andrew, H. M. Inspector in Govan, whose remarks indicate a possible way of escape.

Mr Andrew:—(p. 518). "The Govan School Board have not for a long time taken any step more likely to tell beneficially upon the work of their schools than the starting of their Pupil Teachers' Institute. It has now been in session for a year. Many of the girls, prior to being apprenticed, have had two—in some cases three—years' tuition in secondary schools. These girls stand out markedly from the others in respect of the excellence of their work: and in view of the large number of girls at the secondary centres under the Board, who would gladly take pupil teacher-ships, it is to be hoped that only candidates of this kind will in future be selected. . . .

"While, however, the instruction of the pupil teachers in their studies is being thus carefully seen to, there is some danger that their training on the practical side may not receive the same attention. They are mainly employed in the infant department of the schools to which they are attached, and unless the head-master makes it a matter of duty to see that they have some practice in the upper standards in the course of their apprenticeship, they may pass through their whole course without ever having taught any class above the infant stage."

Dr Stewart, (1901 Report, p. 488):—"What the pupil teacher gains by central training at the hands of experts is to be balanced against the loss of training in their own school, which, if intrinsically inferior, may be more sympathetic and helpful, and therefore more useful after all."

So much for destructive criticism. It may not be difficult to arrive at some solution of the problem, in view of the fact that the whole question has been discussed by various associations, such as the School Board Clerks, the Assistant Teachers' Association, a special committee of the Glasgow branch of the Educational Institute, and the British Association, and it has, besides, formed the basis of a multifarious newspaper correspondence, as well as of discussion within the House of Commons, no further back than last June. Remembering, at the outset, that teaching is an *Art*, and is no more to be learned from books than the art of swimming, it follows that apprenticeship is a necessity at some stage or other, preferably at the beginning. The recent conference of School Board Clerks suggested a four-years' course, beginning at the age of 15, and carrying the third and fourth years' salaries of £46 and £40 for males and females respectively, but such a proposal does not meet the difficulty at all. I am inclined, rather, to support the recommendations of the E.I.S. Committee to the effect that pupil teachers should not be indentured before the age of 16, and then for two years only, but there is no necessity for insisting on a higher standard of entrance examination than that denoted by three lower grade Leaving Certificates, more especially if these certificates gradually rise to the standard which they reached before 1892, when elementary and quasi-secondary schools were admitted to that examination. The pupil teachers would thus be drawn from pupils of a secondary school, in accordance with the recommendation of Mr Andrew, they would there have advantages superior to those offered by a pupil teachers' institute; these schools are better organised, and their curriculum has been the subject of careful revision as seen in circulars 221 and 234 of the Scotch Education Department, presenting now the most complete and logical scheme of "modern" training to be found in this country. Further, these boys and girls are there as pupils only, studying all day as against the half-day of the Institute, free from the work of teaching, and under the charge of specialists who, it may be said without offence, are more thoroughly qualified for their work than the staff of the younger and less experienced institutes. There is no difficulty, under such conditions, in obtaining three lower-grade certificates, and, indeed, the E.I.S. Committee think that higher qualifications may quite well be demanded. I should rather keep to the three certificates, allowing any surplus energy to expend itself along the other subjects of a higher-grade school—Drawing in all its branches, Manual occupations, and especially experimental and other practical work in Science, chiefly elementary physics and "alternative" chemistry, with physiology and hygiene for girls. Thus, on entering his apprenticeship, a pupil teacher would possess the lower-grade Leaving Certificate in English, Mathematics (Higher Arithmetic for girls), and Latin or French, besides an elementary knowledge of science sufficient to serve as a basis for further work, and a fair amount of hand and eye training as represented by the course of Drawing and Manual occupations offered by such a school.

Since the curriculum of an elementary school extends over eight or nine years, such a pupil teacher, entering upon a two years' apprenticeship, and working for half the day in the school, and the other half in the Institute, would be able to distribute his services over several departments. One session could be given to the Infant Division, not necessarily to the same class, in order to gain a practical acquaintance with kindergarten work and other specialities of the infant room. Half-a-session could be given to the Junior Division, and another half to a class in the Senior Division, preferably a class demanding special treatment in Drawing, Nature-knowledge, or other speciality of that particular school or district.

Such a distribution of pupil teachers, however, can only be possible if they are reckoned as supernumaries, not counted on the staff; at present, as already remarked, the tendency is to confine them to the Infant Room, and in many cases they never leave it during their whole apprenticeship. In some cases it may even be desirable to circulate the pupil teachers through typical schools, so as to widen their horizon by giving them a taste of different manners and methods, but such a circulation would perhaps be more appreciated at a later stage, to replace the obsolete practising school system of the Training College.

At the age of seventeen or eighteen a pupil teacher is hardly ready to appreciate the merits or appraise the points of diverse systems, and the proposed postponement for a couple of years would certainly make for greater intelligence. While practical work in the schools is thus in progress, scholarship is being overhauled in the central classes. Since all entrants possess the lower-grade Leaving Certificate or its equivalent, it is not too much to ask that they shall aim at a higher-grade in these subjects by the end of their second year. This would enable the better students to pass the preliminary examination at the University, and enter upon the course of study for M.A. or B.Sc., as will be discussed later on. Drawing, which was begun in a secondary school, should now be completed, and on modern lines, introducing black-board, colour-work, and design. It is very questionable whether the great amount of geometrical drawing and perspective now demanded is of the slightest use to teachers. These subjects are in their proper place for draughtsmen and artists, but what teachers want is plenty of freehand and free-arm drawing, from the flat and from actual objects, in pencil, chalk and colour, and in every case with a view to design and especially to scholastic work; such a course of Drawing, in short, as is laid down by the Department in Circular 294.

Many teachers can make beautiful copies of some intricate example of classic ornament, but they are utterly unable to sketch on the blackboard before a class the simplest natural forms in illustration of their own lessons. And this is a distinct loss to all concerned; the helpless teacher sends in requisitions for diagrams, landing his Board into needless expense, and the scholars are defrauded by having these foisted upon them instead of a simple, personal, living diagram produced before their eyes, of which they can say, "'Tis a poor thing, but mine own." I repeat, no shop diagram, however highly coloured and beautifully mounted, can compete in class interest or educative power with a drawing in white or coloured chalk done by their own teacher in their own lesson. Such diagrams they will imitate for themselves, a thing they are never tempted to do with shop productions. And, after all, what is drawing but a form of composition, the expression of thought by form! When a man finds his descriptive vocabulary running short, he whips out a pencil and supplements his oral picture by a sketch. And what is said here about diagrams and maps applies with still greater force to apparatus. What interest attaches to a school-made galvanometer, battery, or induction coil, and how many boys will be encouraged to try their "'prentice hands," the very thing for which our schools exist, *education*, taking out of a boy what is in him.

One branch of study generally neglected, alike in school and Training College is Music, vocal and instrumental, yet every teacher has now to teach music, and instrumental work has become an indispensable adjunct of physical drill from the Infant Room up. The whole subject remains half-a-century behind, and is even further back relatively, owing to the advance in other subjects. When *music* and not *singing* is taught, Pupils of our primary schools have no difficulty in passing the "elementary" or even the "intermediate" examination of the Tonic-Sol-fa College, and this latter certificate falls very easily within the scope of a secondary school, to say nothing of a Pupil Teachers' Institute. Certainly a teacher who has to teach singing, set ear exercises, and generally comply with the requirements of our best schools, will find himself very poorly equipped unless he possesses at least the intermediate certificate of the Tonic-Sol-fa College or its equivalent. The Bluebook bears ample testimony to the comparatively backward state of this subject in the Training Colleges. But our whole conceptions of musical education require amendment. Colin Brown used to tell us in the old Andersonian days that he estimated musical education in the same way as he judged an English education. I expect a man who possesses the latter to read with fluency and intelligence a passage at first sight; to write from dictation with correct spelling and punctuation; to be able to analyse a sentence and parse selected words in it; finally to give me, either orally or in writing, his ideas on a given theme.

So in music, he says, the self-styled musician, to make good his claim, must be able to sing or play a piece at first sight with fluency and expression; to write down at least the melody of a harmonised piece played or sung to him; to analyse a part song in respect of harmony and melodic structure; finally, to write the lower parts for mixed or equal voices to a given air. These are the very lines of the Tonic-Sol-fa system of training. I should be inclined to restrict *Science* teaching in the central classes to physical geography, and such simple notions of animal and plant life as are required for Nature-study in our day-schools; such a course, for example, as is outlined in circular 369 of the English Education Department, leaving the systematic treatment of the sciences concerned—Geology, Botany, Zoology—for the Training College, or, better still, the University.

We have now to consider the place occupied by the Training College in the professional career of a teacher, and here the critics are all but unanimous. There are eight Training Colleges in Scotland, all controlled by Church Committees; three each belong to the Established and Free Churches, and one each to the Episcopal and Roman Catholic bodies. With the exception of the Roman Catholic College, a modern building, the fittings and equipment of which are "of exceptional excellence," to quote Dr Stewart, the colleges are fifty years behind the times in respect of appliances. With the same exception, the "denominational taint" is so slight as to be almost imaginary, and as a matter of fact women gladly crowd to the Episcopal College in Edinburgh simply because their chances of admission are somewhat better there. On this side of the Tweed we have reason to congratulate ourselves on the complete absence of that intense denominational and sacerdotal spirit which operates so adversely to true progress, not only in England, but everywhere. "Le cléricalisme, c'est l'ennemi." These eight colleges are attended by 1,250 students, fully half of those entitled to enter, and the successful candidates are instructed at a cost per head of roughly £52 per annum. Practically all entrants have been pupil teachers; not a single male passed 1st class in '99 who was not a pupil teacher, and only 15 females; and, as has been already remarked, the best places on the list, carrying bursaries and university privileges, are falling in increasing proportion to the city pupil teachers, trained on the central class system. Although looked upon as "Normal" schools, in the sense of model or typical establishments, when they were built in 1843 or thereby, "I fear it would only be by a stretch of imagination," says Dr Stewart, "that we should think of regarding them as Normal now.

Moreover, the term some years ago was slightly contemptuous when Normal students and University students were referred to in contrast." If these strictures refer to the buildings and general equipment of the Training Colleges, still more severe and contemptuous is the language used of their system and curriculum, although it must be remembered that the Training Colleges have had to teach to a syllabus laid down for them, nolens volens, by the Education Department, and that only within this last year has the reforming energy of the Scotch Department come their way. The institution of the Leaving Certificate of Higher Grade Science and Commercial Schools, the radical and progressive developments in Drawing, Manual Instruction, Hand and Eye Training, Physical Drill, the still more recent assertion of Nature-study, as I prefer to call it, as a compulsory part of the school curriculum, and the abolition of fixed standards and stated inspections—all these changes have left the Training Colleges untouched, and the subjects and methods in vogue to-day are, with quite insignificant exceptions, those of twenty-five years ago. Listen to a member of perhaps the most progressive School Board in Scotland:—

"It is generally recognised," says he, "that the normal system is inadequate, and that the normal colleges are somewhat inefficient. The inadequacy arises from want of room; the inefficiency from want of proper equipment and lack of facilities for actual training. To take the latter point alone, what real facilities can be offered to the future teacher by a normal college with, say, 200 students and only one practising school? The practical training in such circumstances is bound to be, as it is very well known to be, of a very nominal character." Commenting upon Mr Bryce's motion in the House of Commons on 21st June last, the *Glasgow Herald*, usually regarded as safe and conservative in educational matters, went the length of saying:— "The Training Colleges have undoubtedly done good work in the past, but in all probability even their warmest admirers will admit that they cannot long continue as they are. Either they must be taken over by the State and secularised, or they must be superseded by the Universities." The Lord Advocate, replying on that discussion, indicated clearly that at the present moment the Education Department had no intention of burdening itself with the Training Colleges. It is also abundantly clear that the Universities are unable to impart the more professional and technical part of a teachers' training, whatever they may do when their resources are increased by the munificence, no less welcome than unique, of Dr Andrew Carnegie. The testimony of pupil teachers, especially city pupil teachers, who have passed through the Training Colleges is absolutely unanimous; the two years spent there were a waste of time, an absolute declension in modern languages and science, while the very mention of School-management as a subject of the curriculum excites a smile, if not ribald laughter. Others, less severe, praise the Normals for giving a welcome rest after the hard work of apprenticeship, for opening up a wider social circle; only one teacher have I ever heard testifying that he received any benefits in keeping with their pretentious claims as *Training* Colleges, and he was one of that class whose disappearance has already been deplored, a lad taught in a small country school, a "lad o' pairts," as his career has proved, but handicapped by want of opportunities, with neither drawing, mathematics, modern languages, nor science. One good thing the Normals have done, they have sent up their best students to the University under the arrangement of 1877, and in 1898 no fewer than 398 students entered the Universities by this door, of whom something like 160 were females.

The Free Church Colleges have always been very generous in this respect, and the pass list recently issued for July, 1901, shows that out of 65 men of both years in the Glasgow U.F.C. College, only one was not at the University, and only 4 ladies out of 59 in the second year.

In order to discover the cause of this comparative uselessness let us examine the curriculum of the Training Colleges in connection more especially with the examinations at entrance, end of first year, and exit, and it will be of still greater service if these examination papers are collated with those of the Society of Arts, the Higher Grade Leaving Certificate, and the preliminary and degree examinations of the University.

Now on studying such a curriculum with the actual examination papers as commentary, the following points emerge for criticism. In the first place there is a great deal of "vain repetition." Bearing in mind that the entrance examination is admittedly on a level with that for Higher Grade English in the Leaving Certificate scheme, it seems a waste of time to give two years to the English subjects, only to attain the feeble standard of the exit examination. The holder of a higher Grade Leaving Certificate in English, is entitled to attend the English class in the University; one session takes him over the work required for the ordinary degree of M.A., and two sessions give him the honours course. Will anyone venture to say that the exit examination of the Training College, representing two years' work in English, is worthy of mention, let alone comparison, with the thorough test and the superlative scholarship demanded by the fourteen papers of English Honours for the M.A. degree? If a man, and a teacher to boot, has not learned to write and spell before he is eighteen years of age, he will not learn these in the Training College or anywhere else. I grant that its spelling test is one of the weak points in the Leaving Certificate even in the lower grade, and I should be glad to see the present dictation test supplemented by a pure spelling test on the lines of the Civil Service examinations. Even scholars in elementary schools submit to such tests, and in this, as in many other matters, the pupils are leaving their teachers behind.

Again, take Mathematics. In order to enter the Training College men have to profess four books of Euclid, with props. 1-9 of the sixth book, Algebra to quadratics, and the elements of mensuration; that is to say, their attainments in mathematics are very much lower indeed than the demands of the higher-grade Leaving Certificate, and it is only at their exit examination that they reach that standard, with the addition of elementary dynamics. If they had passed the corresponding entrance examination at the University, or entered it by a higher-grade certificate in Mathematics, their progress would have been very different. In one session of six months a student taking the ordinary mathematics class, covers all the ground of the Training College course, and has begun Analytical Geometry in addition, while in his second session he has added to these the Differential and Integral Calculus. And this is the ordinary course; the better students will begin ~~with the~~ "Intermediate Honours" class, and in their second session take "Advanced" work, comprising such subjects as Integral Calculus, Spherical Trigonometry, Geometry of three dimensions, and Differential Equations. Besides, they have a recognised status, a handle to their name; even if they do not complete the degree course, they have at least a University certificate to show. What have the Normal students?

It will be noticed that Geography and History figure only in the entrance examination, an arrangement, both good and bad, which has now obtained for twenty-five years. Before that

TRAINING COLLEGE EXAMINATIONS.

Entrance.	End of First Year.	Exit.
Compulsory Subjects.	*Compulsory Subjects.*	*Compulsory Subjects.*
Reading and Repetition.	Reading. (F).	Reading. (F.)
Penmanship and Dictation.	Penmanship, &c. (F.)	Penmanship, &c. (F.)
English, Grammar, and Composition.	English, &c. (F.)	English, &c. (with a period of English Literature). (F.)
Arithmetic.	Arithmetic. (F.)	Arithmetic.
Mathematics (men)— Geometry, Euc. I.-IV., VI. 1-9. Algebra to quadratics. Mensuration.	Mathematics— Euc. I.-IV., VI. 1-9. Algebra to proportion. Mensuration. Elem. Dynamics.	Mathematics— Euc. I.-VI. Algebra to binomial theorem. Mensuration. Trigonometry to solution of triangles.
Geography and History.	——	——
Teaching and School Management.	——	Elementary Political Economy.
Needlework and Domestic Economy (women).	Needlework. (F.)	Teaching and School Management.
	Domestic Economy.	Needlework. (F.)
Optional.	*Optional.*	*Optional.*
Music.	Music.	Music.
Drawing.	Drawing.	Drawing.
1 Language	2 Languages.*	2 Languages.*
1 Science.	2 Sciences.	2 Sciences.

F. Failure to attain 25 per cent. of the marks in any of these subjects involves complete failure.

* Only if two are taught as set forth in the time table ; in practice only one.

LEAVING CERTIFICATE EXAMINATIONS.		UNIVERSITY EXAMINATIONS.	
Lower.	Higher.	Preliminary.	M.A. Degree.
Arithmetic.			
To decimal fractions, simple interest, and square root.	The whole subject.	To decimal fractions, simple interest, and square root.	——
Geometry.			
Euc I.-III., with deductions.	Euc. I.-VI., XI., 1-20, with deductions.	*(Lower)* to Euc. I.-III. *(Inter.)* to Euc. VI. 1-19. *(Higher)* to Euc. VI., XI. 1-21.	Euc. I.-VI., XI., 1-21. Analytical Geometry of point, line, circle.
Algebra.			
To quadratics and surds.	To binomial theorem.	*(Lower)* to quadratics. *(Inter.)* to proportion. *(Higher)* to proportion.	To logarithmic and exponential theorems.
Elem. Dynamics.			
(Optional.)	Elem. or Higher Dynamics. *(Optional.)*	Elem. Dynamics. *(Optional.)*	Elem. Dynamics.
Trigonometry.			
——	Elem.— To solution of triangles. Higher.— To De Moivre's theorem. *(Optional.)*	*(Lower)* —— *(Inter.)* Right-angled triangles. *(Higher)* to solution of triangles.	To solution of triangles.
English, French, German, Italian, Latin.	*See* Report of Education Dept., 1900-1.	*Standard* equal to Higher-Grade L.C. *Lower*, equal to Lower-Grade L.C. *Higher*, equal to Higher-Grade L.C.	*See* University Calender, pp. 177-186.

time History meant chronology, mere memory work, and therefore the sooner it was dropped the better. But there is room for a proper treatment of History as the basis of Politics in the best sense of the term, and correlating it with Geography, Literature, and Political Economy. What a training lies, for example, in the Eighteenth Century of Scottish History, as recently treated by the head of our Education Department, an episode in the physiology of a nation, the most interesting of all organisms. It is easy to draw a fanciful picture of a course on the Jacobite movements, which should include the Jacobite songs and ballads, and receive due geographical treatment by the lantern, supplemented by a well-chosen excursion or two, and treated generally as the subject is supposed to be treated in higher-grade schools under circular 221. It is matter for regret that only in rare instances do teachers draw upon the wonderful treasures of Scottish song and modern fiction to give life and energy to what is often a repellant if not repulsive subject. Even where a school library exists, teachers are not always sufficiently careful to select and recommend fiction bearing upon the matter in hand.

And Geography :—In the old days it was the kind of thing one gets in a small gazetteer, supplemented by the drawing of elaborrate maps, with parallels and meridians inserted, and no one has ever been heard to regret its disappearance. But surely there is room, in these last days, for rational geography, "a description of the earth and of animated nature," which shall be personal and practical, appealing as little as possible to the memory, but a very great deal to observation and judgment. In circular 221, already referred to, the Scotch Education Department expect from pupils in higher-grade schools a " thorough regional survey, by means of excursions, of the physical geography, flora, fauna, and historical antiquities of the district in which the school is situated," besides, such a knowledge of the principles of commercial geography as will render the commercial pages of a daily paper not only intelligible but interesting. How many teachers have ever had the opportunity of taking the latitude and longitude, both operations very much easier than inserting from memory any number of parallels and meridians?

We can all define the terms, and in Geography they have still some idea behind them :—N. Lat. 51 degrees and W. Long. 4 degrees, suggests a certain spot on the map. But what about R.A. and Decl., terms we could also define? Take a Physiography student to the roof of this building, and advise him of a comet in R.A., 17 hrs. 45 m., and N.Decl. 17 degrees, and which way would the poor fellow turn? Words, mere words: filling his belly with the east wind. Drawing and colouring an elaborate map is good, making a rapid and accurate sketch map before a class is better, but the ability to map a landscape is better still, and this is what is demanded not merely by army officers, but in Standard I., where in the old days the children had to be taught the meaning and use of a map. Here, also, the Department has recently laid down correct lines :—"Geography. A course of lectures on the study of geography. Practical exercises in the construction and use of maps, including sketch maps from rough surveys of the physical features of neighbouring localities." (Circular 329, Appendix A, 6). And the so-called "new" subject, Nature-Knowledge, what is it, after all, but genuine Geography—"a description of the earth and of animated nature," such description including the drawing of actual natural objects. This is an elementary school subject. Who is to teach it, and who shall teach the teachers? Here, also, the scholars are leaving their teachers behind. Reintroduce the subject, then, as Practical Geography without a text-book; let it include practice in the use of clay and sand, on the lines laid down by Dexter and Garlick, a complete course of surveying and mapping, a course of surface geology from demonstrations and weekly excursions; an acquaintance with the flora, fauna, and historical antiquities of the district; practice in preserving and mounting specimens, with a view to the school museum later on — such a course of well-planned and well-conducted excursions, say, every alternate Saturday throughout the session would thoroughly fit a teacher for grappling with the more modern developments of his school work, would prove an admirable foil for the book-work which is indispensable in other subjects, and would brighten up what is at present to many a tiresome period of probation. Nor should marine work be neglected. Here in Glasgow we are wonderfully well-off in possessing a valuable marine station at Millport, and every Glasgow child is "doon the watter" for at least a week at the Fair, so that there is no reason why every teacher in the Western District should not be thoroughly interested in the "common objects of the seashore." Listen to Sir John Murray opening the Teacher's Class at Millport last May. After vindicating, even on the low commercial standard, the existence of marine and other research stations, Sir John then proceeded to speak of the second great function of such institutions which he conceived to be the training of young and receptive minds in the methods of science. In this country at the present time this function is probably of far more importance than any other to our national development, for it is a necessary preliminary to discovery as well as to industrial and commercial success. It is not so much the storing of the mind with facts and the latest results of science as teaching men how to observe and to think and reason concerning their observations, and to cultivate the receptive faculty, a phase of education which seems to be almost wholly neglected in our present system. Sir John concluded his address by expressing his satisfaction at seeing so many teachers desirous of adding to their store of practical knowledge, and was glad they were met under the auspices of the educational authorities, who in this step had taken more or less of a new departure which might prove of incalculable benefit. In a last word he would bid us all remember that professional knowledge and technical skill does not constitute science, but the methodic training of the receptive faculty, the bringing before the mind's eye the results of their research and observation.

"It is easy for me," he went on to say, "to tell a student that the temperature of the sea at forty fathoms is so many degrees centigrade." There is no training in that, he has added another fact in physical geography, and facts of that kind are like holes in golf or runs in cricket, they are of no use to you when you get them, but to get them is the game. But put that student on board the *Mermaid* to take some soundings under the supervision of the officers of the station, show him the difficulties which have to be met, the motion of the vessel, the drag of tides and currents, mechanical difficulties in the way of lowering and raising the line, show him how to sample the bottom, to secure accuracy of registration in his thermometer, and so on, *give him a share in doing it*, and what is the result? He may forget the temperature an hour later—and what though he does?—but he has received a training in meeting and overcoming difficulties which will make him a "handy man," resourceful, patient, victorious.

Take again the feminine subjects of Needlework and Domestic Economy, why should they appear on the curriculum at all? Considering that your girl pupil teachers have had both these subjects for at least four years and can sew as well at 18 as they will ever do at 20, is it worth while to waste an hour per day on these subjects? They are both marked "failing" subjects at entrance; very well, then; exclude the failures, but pass the "passes" and save them other two years of "vain repetition." There are no more popular subjects in our Continuation Schools for women than Millinery and Dressmaking, but here again we are brought face to face with the fact that the instruction given in the Training College has no connection with the practical work of a school, for ladies who wish to qualify as teachers of Millinery and Dressmaking have to be specially trained elsewhere, like teachers of Cookery and Laundry Work. In the same way the drill given at the Training College is quite divorced from that used in schools, and teachers have to undergo special and extramural instruction. The same thing is true *a fortiori* of Drawing and Music, and indeed in most subjects teachers very soon find after leaving the Normal that their training has yet to be begun. This is the real explanation of the enormous development of what I am calling "extramural" classes, classes for the further training of teachers under *Article 91 (d)* of the Scotch Code, in Drawing, Manual Instruction, Nature-Knowledge, Drill, Ambulance Work, etc., etc. The Department are quite alive to this necessity and have made provision for meeting it, as will be seen by a reference to circulars 221 and 294, but these are the very subjects which one would expect to fall naturally into the curriculum of a Training College.

My contention against the Training Colleges is that they have left undone that which they ought to have done, and they have done that which they ought not to have done, or, at least, which could have been done much better elsewhere. Again let it be understood, however, that these objections are to the system, not to the teachers or governing bodies; they have had to teach on the lines of examinations laid down for them by an external and irresponsible authority. This paper is not a critique, but a flashlight photograph.

Before proceeding to discuss an ideal Training College, it will be necessary to glance at a recent development which has arisen out of the institution of King's Studentships.

The condition and status of King's Students are clearly defined in Articles 83-98 of the Scotch Education Code. Briefly speaking, this side-door into the teaching profession is open to pupil teachers who have passed the preliminary examinations of the University, or the entrance examination of the Training College, or who hold three higher-grade Leaving Certificates in English, Mathematics (Arithmetic for girls), and an ancient or modern language. Instead of entering a Training College they are under the care of a local committee, attend the University classes, and get a certain amount of practical training in schools, the whole course lasting two years. Government grants are paid in respect of these students, and the Department have done a great deal to encourage this movement. Committees have already been formed at the Universities of Aberdeen and St Andrews, and University College, Dundee, and the popularity of the movement is evidenced by the rapid rise in the attendance at these centres during the four years ending 1900, the numbers being for Aberdeen, 3, 15, 40, 55, and for St Andrews, 3, 14, 29, 35, the two centres giving an output almost equal to that of a Training College.

Mr Robertson, H.M. Inspector for Inverness, would apply this new system to the solution of the training difficulty in rural districts. "On closer study, and especially in view of the difficulty of securing competent native junior teachers for the outlying districts, I would go further and recommend for consideration the idea of allowing central schools under well-defined conditions to train ex-pupil teachers and others for at least the first year's paper of the Acting Teachers' Examination. Such a devolution of function from the Normal School system appears to me to be justifiable on many grounds, and not least on educational." (Sc. Educ. Report, 1901, p. 571).

Now when it is remembered that the Training Colleges are able to accommodate only half the number of teachers required annually, and that the instruction given in them is admittedly better given elsewhere, it would seem as if these King's Studentships would gradually attract more and more of the city-trained pupil teachers, leaving the original Training Colleges to serve the country schools, the curriculum and demands of which are not so varied or exhausting. The one blot upon the scheme is the admission of non-pupil teachers, persons over 18 years of age, who have never handled a class at all, though their scholarship may be fairly high. We have had them in our schools, and every head-master will support the contention that in school work teaching power is first and scholarship a bad second, and our experience shows that, as a rule, these "young persons over 18 years of age" are a source of weakness rather than strength.

Supplemented by a thorough practical and professional training, these King's Studentships may be the means of solving the clamant problem of teaching supply. Glasgow alone—I mean the City, in the popular sense, not simply the School Board area—takes 100 teachers per annum, the entire output of a Training College at its best. [Last year the School Board of Glasgow alone took 93 teachers, but this was exceptionally large, and due to the new Code.] What is to hinder the School Boards of Glasgow and Govan from acting as a Committee in terms of the Code, and training their own teachers, all the more that city teachers require special training? The London County Council are building a Training College for London teachers; why not Glasgow? It may be said that the training of teachers is no part of the work of a School Board; my reply to that is that the School Board have been training teachers for the last ten years, having been constrained thereto by force of circumstances. They have instituted practical classes for their teachers, have paid their fees, when there were any, and even their travelling expenses, and the subjects selected are precisely those which are wanted in every day-school, but which are not to be had in any Training College, such as modern Drawing, Brush-work, Design, Drill, Ambulance, Cardboard and Woodwork, Nature-Knowledge, and others. Similar classes are being held all over the country by local branches of the Educational Institute of Scotland, assisted by the Technical Education Committee of the County Councils, and directly encouraged both by way of direction and grants by the Scotch Education Department.

These large boards have ready to hand their central classes or Pupil Teachers' Institute. What is wanted is merely a continuation course of two years, the "book" subjects being taken in the University, and the "professional" subjects in the Institute, while the practical training is got, as at present, in the schools under the Board. And here emerges one point of some importance. The Training College has only one practising school for 200 students, the nett working session is only some 35 weeks: how much practical school work is possible? The very mention of it calls up a smile on the faces of those who have gone through the "departments" in Normal parlance. The practising schools are anything but "normal" in the sense of typical, still less are they model schools, and they are far behind most of the city schools in buildings, fittings, and curriculum. But the School Boards of Glasgow and Govan alone have at command over 100 modern schools, many of which have made themselves famous along special lines. One school has a reputation for Colour-work and Design, another for Woodwork, another for Brush-drawing, a fourth for Nature-Knowledge, a fifth for Kindergarten, and so on. Why not select, say, ten or more typical schools and distribute the King's Students over these as the pupil teachers are at present? They might be supernumaries on the staff, and would thus be free to circulate among these schools, spending, say, one term at each, and so becoming practically acquainted with all the workings of a first-class modern school. This is the course actually adopted by the training-schools of cookery. Not only do the cookery students attend as a class so many demonstration lesson given by the resident cookery teacher of a school, but they are told off individually as aide-de-camps to the cookery teacher in her ordinary practice classes. While thus engaged, the King's Students could be in receipt of an ex-pupil teacher's salary, which is a great advance on the terms offered by the Training College, and I am assured by the gentleman already quoted that "the financial aspect has been carefully looked into, and there is no doubt as to the absolute stability of the scheme."

The following peep into Normal finance is startling, and is made just cause of complaint by the Ladies' Committee of the Glasgow Educational Institute. The Training Colleges are credited with £100 for every male, and £70 for every female teacher who has received the Government certificate ("parchment"), after passing through them, and both men and women, thus certificated, are reckoned of equal value on the school staff, so that the committee considers the following arrangement of bursaries unfair :—

> *a. Men* who enter the Training College by the University Preliminary Examination, each receive a bursary of *£25 annually, subject to a deduction of £5* for Training College fees and books. *Women* who enter by the same examination receive bursaries of *£5 annually, subject to the same deduction of £5*, and to a possible further deduction for instrumental music—if they have any knowledge of that subject.
>
> *b. Men* who are granted a third year at the University receive a bursary of *£15*. Women for the same receive *£5*.
>
> *c. All the men students* receive bursaries—in the first year £25 and £23 or First or Second Class pass in the Scholarship Examination, or its

equivalents, subject to the above deduction of £5. *Only fifty per cent.* of the women students, *however* admitted, *receive bursaries of £5*, while all pay £5 for fees and books, and almost all a further fee for instrumental music.

NOTE.—It would, seem more reasonable to ask students who have no knowledge of this subject to take lessons, than to compel those to do so, who have already a proficiency equal to the needs of a public school.

d. Should a man student fall into the third class in an examination held by the college at the end of the first year's course, his bursary of £25 or £23 is reduced to £21. In like case, the woman student's bursary of £5 is withdrawn.

Such a scheme has been proposed by the Govan School Board, which in many respects is leading Scotland in educational matters, and it is admirably suited to all the large centres, which, among them, absorb more than four-fifths alike of the population and teachers of the country. The buildings are those, in most cases, of the most modern type, whereas the Training Colleges have no laboratories or appliances for manual training of any kind, even to the mounting of a microscope slide; the teachers are there, comprising the staff of the Pupil Teacher's Institute, the special teachers appointed by these Boards, and the University professors; the students are those in the Board's own employment, and designed for work in their own schools; there is an excellent choice of practising schools affording an all round training in even the most recent developments of education; the Universities will benefit to the extent of two hundred students; and finally, the students themselves will benefit, not only in real training, but in pocket.

The proposals of this paper hitherto may thus be summed up: —Pupil teachers are to be apprenticed at 16 for a two years' course, and to be chosen as far as possible from the pupils of a secondary or higher-grade school, on the basis of the lower-grade Leaving Certificate in at least three subjects, English, Mathematics (Arithmetic for girls), and a language. During their apprenticeship they will receive instruction as before in the Institute for one half of the day, and teach in a school the other half. To ensure that they get a proper share of all the school work, they should not be reckoned at all on the staff, and the Department is entitled to insist on their spending one year at least in departments other than the Infant Room. Within the Institute let them be classified according to their ability, not according to age or year, and let the classification adopted give the same freedom as that now enjoyed by Elementary schools, in which the progress of a boy in arithmetic say, need not depend on his attainments in English. At the end of their two years' course they will sit the Studentship examination, or the University preliminary, or the Leaving Certificate Higher-Grade in the necessary subjects, preferably this last, since it comprises the others, and the successful candidates will enter upon a further course as King's students, teaching part of the time as before, not necessarily half-day—it may be whole day during the University recess—and spending one term, or its equivalent, in each of selected typical schools. On the expiry of this course many would, doubtless, proceed to complete their studies for the M.A. or B.Sc. degree, while the others would come within the scope of Article 48, and thus be exempted altogether from the Certificate examination, since it may be assumed that Education would be a compulsory subject in their University course. The University would thus give these students all their training on the side of literature and science, English, Latin, French, German, Education, Physics, Chemistry, Geology, Botany, Zoology, Physiology; the Pupil-Teachers' College would see to the more technical subjects, such as Drawing, in all its branches, Drill, Manual Instruction, and so on. In our city, even the Drawing subjects might, with advantage be "devolved" upon the School of Art, which enjoys the reputation of being among the first, if not the very first, in the United Kingdom.

Are the Universities ready for this change? not so long as the preliminary examination in Arts demands Higher-Grade Latin. Three-fifths of our teachers are females, and to ask them to devote at least three years of a valuable period in their lives to the study of Latin, merely to enter the Arts faculty for graduation, is simply to suggest a sinful waste of human life. To a teacher, male or female, the sole use of Latin is to throw light upon an English dictionary and even in this respect it is far below German, which illuminates, not merely the most useful part of the vocabulary, but also the grammar and structure of the English language, and which, moreover, is simply indispensable to any one who wishes to keep himself abreast of modern thought and action. The latest utterance of the Department on this point is eminently sensible. For non-university students there is now demanded: "An elementary study of Latin, with a view to the better comprehension of English. This should comprise a study of the common Latin word-forms and constructions, especially in their bearing upon the structure of English. It should be carried to such a point as to enable the students to make out the meaning of easy passages from a Latin delectus." Circ. 329, Appendix A. 1 (d).

Formerly women had no Latin, and men of the non-university type required far too much.

Pending the establishment of a Faculty of Education, to which Training-Colleges and Pupil-Teacher Colleges alike could be affiliated for the practical subjects, I strongly advise degree students to study for B.Sc., rather than M.A. The preliminary examination in Science means, say, higher-grade English, Mathematics, French, German ; the degree course includes at least seven subjects, all of immediate practical application in school work ; the standard of examination is that of M.A., with Honours ; and it leads to the degree of D.Sc. The "first examination" is an admirable preparation for Nature-Knowledge, comprising as it does Botany, Zoology, Physics, and Chemistry, and students will have no difficulty in selecting three other subjects for their "final," and were I consulted, I should name for two of these Geology and Physiology. If the last subject cannot be taken, teachers should at least acquire a thorough training in Ambulance work, say a three month's course. My own experience in city schools gives an average of one accident per month, demanding more than common domestic treatment, while not sufficiently serious to involve immediate medical attendance, and the Glasgow School Board have recognised this by supplying an "emergency box" to all their schools, and opening ambulance classes for their teachers.

So long ago as 9th August, 1899, the Scotch Education Department requested the authorities of the Training-Colleges to set their house in order, giving them at the same time something of the freedom in matters of curriculum which elementary schools at present enjoy. Commenting on this circular the *Scotsman* says : If the Training-Colleges are to remain denominational for ever and ever, the proposal of the Department seems to have much to recommend it. . . Is it desirable to give a new lease of life to the system by which the training of our national teachers is left in the hands of the Churches ? Should the system be made perpetual ? . . . One way of interpreting Sir Henry Craik's letter would be to treat it as a warning that, if the Churches are not prepared to make such an effort, the denominational Training-Colleges are doomed. . . . Would it not be better, even if there be difficulties, to nationalise the Training-Colleges at once, if the time has come for a change of their status and an enhancement of the value of their certificates?

The more progressive of these Colleges are endeavouring to make up their leeway, but some years must elapse before they are abreast of a good modern school. Even if they are thoroughly efficient to-day, the fact would still remain that they can accommodate only one half of the teachers in demand, and this in spite of the further fact that the demand for teachers will rise continuously, not only by natural increase of population, but by changes in the code tending to diminish the size of certain classes. At present a teacher counts for sixty pupils, but in all manual subjects, *e.g.*, manual instruction, cookery, laundry, class excursions, the number is restricted to eighteen, and a similar concession will have to be made in respect of drawing, writing, kindergarten, hand and eye training, laboratory practice and needlework. Add to this the extra demands due to increase in the average attendance, and the certainty of an increased exportation of Scottish trained teachers to England and the Colonies, and it will be seen that provision must be made for accommodating 2,000 teachers instead of 1,140, as at present (now raised to 1380, Aug. 1901).

Since this paper was written (July), the Scotch Education Department has issued (30th Aug., 1901), the very important circular 329, which revolutionises the whole curriculum of the training colleges, and asserts the distinction, so strongly maintained here, between subjects of general culture and the more professional or technical subjects.

The following outline is from the Glasgow *Herald*, but the circular itself should be studied for its very valuable appendix, already quoted, giving details of the curriculum for non-university students.

> THE TRAINING OF KING'S STUDENTS.—Sir Henry Craik, the Secretary to the Scotch Education Department, issued a circular to training colleges and local committees for the training of King's students. Following the precedent set in the case of science and drawing last year, the Department, he explains, has now resolved as regards the other subjects also of examination for students in training to *depart from the practice of examining the students upon a uniform prescribed syllabus*, and, subject to certain general conditions, to invite the authorities charged with the training of teachers to submit for approval the courses of instruction which they deem best suited for different classes of students. To facilitate the formation of

> well ordered and coherent courses of study, covering the whole period of the student's training, it has been resolved to ***discontinue the separate examination at the end of the first year of training.*** In framing courses, regard should be had to the following considerations:—(A) The students dealt with fall into main classes—viz., (1) those who, being qualified in terms of article 95 (D) or 96, are in attendance at university classes; and (2) those who are not. A separate course of instruction should be submitted for each of those classes of students. (B) The subjects of instruction also fall into two main classes—viz., (1) those intended to secure a sufficiently high level of general culture on the part of the students themselves, and (2) what may be termed professional subjects. The provision to be made under both these heads for each of the foregoing classes of students should be distinctly shown. (C) The work of the university students —and in a less degree the work of the non-university students—will naturally fall into two distinct periods in each year—viz., the winter session and the summer session, and a conspectus of the range of work for each session separately should be given. Provision must be made for the due instruction of non-university students in the following subjects: — A — 1, Physical exercises and drill; 2, English; 3, History; 4, Arithmetic, algebra, and geometry; 5, Science; 6, Geography. B—1, Voice production and phonetics; 2, Drawing; 3, Singing; 4, Needlework (for women). C—1, The principles of education; 2, School methods and practice in teaching.

Here is a chance for the Scottish universities in view of their extension under the Carnegie bequest. On all sides demands are being made for a Faculty of Education with suitable degrees, and having the training colleges, existing or prospective, affiliated for the sake of purely "professional" instruction. The Assistant Teacher's Association, as far back as 1894, promulgated such a demand, which has been crystallised into perfect definiteness by the report of a special committee appointed by the Glasgow E.I.S.

EDUCATIONAL INSTITUTE OF SCOTLAND.

GLASGOW LOCAL ASSOCIATION.

REPORT OF COMMITTEE ON TRAINING OF TEACHERS.

(Presented 27th April, 1901.)

REMIT.—"To take into consideration the whole question of the training of teachers and report."

A.—PUPIL TEACHERS.

The Committee approve of the pupil teacher system with the following modifications:—

(*a*) That pupil teachers should not be indentured before the age of 16, and then for two years only.

(*b*) That at that age higher qualifications than three Lower Grade Leaving Certificates or the requirements for Second Year Pupil Teachers should be demanded.

Note.—The Committee do not regard apprenticeship as pupil teacher as absolutely essential to every candidate for training, but they think that a severer test of practical ability should be demanded from those who have not been pupil teachers, than at present.*

B1.—STUDENTS IN TRAINING.

The Committee are of opinion:—

(*a*) That the training of teachers should be undertaken by the Universities.

(*b*) That the Training Colleges should be affiliated to the Universities as institutions providing for practical training, and for instruction in the subjects necessary for a teacher, and not found in the University curriculum.

Note.—It seems to the Committee that the main work of a training college should be training, not instruction, and that the training so given should have a direct bearing on practical school work.

(*c*) That a Degree in Education should be instituted.

Note.—This Degree would represent attainments equal to the present Arts or Science Degree, and would guarantee that the possessor thereof had undergone a course of practical training, and was able to conduct the work of a school.

(*d*) That attendance at a Training College, or Institution where students would acquire a knowledge of the principles and methods of Education, should be compulsory on all candidates for the teaching profession.

Note.—This course of training should include visits to typical schools where the students would become familiar with the various methods, organisation and equipment in use.

---

* The author is not prepared to support this note.

B2.—The Committee, recognising the difficulty of putting into immediate operation the proposals outlined in Section B1, make the following recommendations in reference to existing schemes of training:—

(*a*) That King's Studentship Classes in connection with the Universities, where not already established, should be instituted; the Local Committees in charge of these classes to be representative of the Universities, the Local School Boards and other Educational Authorities; that no one should be recognised as a King's Student who has not passed the University Preliminary Examination.

(*b*) That there should be one qualifying examination for admission to a Training College, preferably the University Preliminary Examination.

Note.—Schedule I. in the Code should be so modified as to make the instruction given under it a preparation for the University Preliminary Examination.

(*c*) That students in Training Colleges who have passed the University Preliminary Examination should be allowed to take the University Classes suited to their course, and should be relieved of all Training College work during the University session.

(*d*) That a course of training should be afforded to a larger number of candidates.

Note.—The Acting Teachers' Examination should be discontinued after due warning (say, five years).

(*e*) That students should be encouraged (by bursaries) to graduate (Education being a compulsory subject in the graduation course).

(*f*) That Travelling Scholarships should be instituted to enable promising students to prosecute their studies in foreign countries.

ALLAN ARNEIL,
Convener of Committee.

It is not for me to sketch the outline and composition of such a Faculty, numbering as it would some 600 students in Glasgow alone. The curriculum would necessarily include English, any two of Latin, French and German, Mathematics, Education, History, Political Economy, Elementary Physics and Chemistry, as for the first "Professional" in medicine, but with very much more practical work, and a similar course in Natural Science, comprising Geology, Botany, Zoology, and Physiology, in short, the kind of thing required by teachers in higher grade, and even in the better elementary schools. The present M.A. course, with some science "options," would almost meet the case, but the compulsory inclusion of Latin as a subject for preliminary and degree examinations would, I am afraid, be a bar to the admission of many men and most women.

In conclusion, let me emphasise once more the need for a proper scientific training, the discipline of *phusis* rather than of *logos*. So far back as 1855 Faraday pointed out the evil effects produced by a one-sided culture based upon books alone, and his warning has been repeated in our own ears by one of the most distinguished ornaments of this Society, Sir William Gairdner, and re-echoed by the present Lord Rector of the University, all witnesses to the truth of the pregnant phase of Scaliger, 350 years old, yet more needed now than ever: *Rerum ipsarum cognitio vera e rebus ipsis.*

III.—*The Photography of Sound Waves and other Disturbances in Air.* By H. STANLEY ALLEN, M.A., B.Sc.

[Read before the Society, 4th December, 1901.]

ACCUSTOMED as we have become to the marvels of science, it may still cause surprise to some to learn that a wave of sound in air can not only be seen, but can be photographed. By a simple application of well known optical principles, it is possible to render visible that which we might regard almost as the type of the invisible, the disturbances of the air itself. Though we cannot yet rival the keenness of perception of Pyramus in "A Midsummer Night's Dream"—"I see a voice"—we can go so far as to say that we can see a sound. I hope to be able in the present paper to explain how this feat may be accomplished, and to show some photographs of ærial disturbances that have been taken in the Blythswood Laboratory.

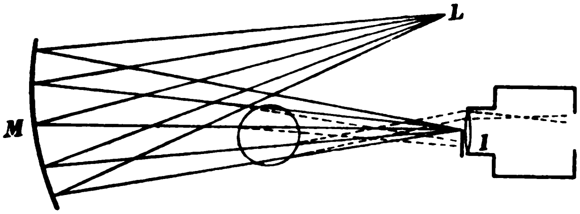
I must apologise if, at the outset, I recall some quite elementary facts in optics, but the method by which the results are achieved is so delightfully simple, that it would be a pity if I failed to make it clear to those present who do not claim to be physicists.

The first fact emphasised in all works on geometrical optics is that light travels in straight lines so long as its course remains in a uniform medium. Although we know that this is not a perfect representation of the truth, and that light can effect to a certain extent the operation of "turning a corner," yet, for many purposes, it is sufficiently accurate. When, however, light passes from one medium into another, we know that in general its course is bent —the light is said to be refracted.

Let us imagine ourselves to be looking through a uniform medium towards a small source of light, when a prism of some refracting material is introduced into the path of the light. Then the light, passing through the prism, may be so far bent aside that it no longer enters the pupil of the eye. In this case the prism, apart from some small amount of scattered light, will appear dark.

It is on this simple principle that the method of viewing disturbances in air—the "Schlieren Methode," or Method of Striæ as it is called—is based. As the difference in refracting power in such disturbances is extremely small, it is of course necessary that the optical arrangements should be very much more exact than in the rough illustration just considered.

One form of these arrangements is shown in the first diagram, Fig. 1. The light proceeds from a source L which is as nearly as possible a straight line. In the figure this line of light is seen only in section—it is supposed to be at right angles to the plane of the paper. The light issuing from this source falls on a large concave mirror, M, by which it is brought to a focus just in front of the lens of the camera at I. One half of the lens is covered with an opaque screen, having a straight edge parallel to the image of the source, and the apparatus is arranged so that the image falls exactly on this straight edge. Then, if all the adjustments are ideally perfect, no light at all will enter the camera so long as the medium through which the light passes is homogeneous. But supposing there is a region in the path of the light having a density different from that of the surrounding atmosphere, some of the light may be bent aside so as to enter the lens of the the camera. Such a region is represented in section by the circle in the figure. It is supposed to be of greater density than the air around. The paths of the rays which have been refracted in passing through it are represented by the dotted lines. It will be seen that light traversing the lower portion is bent upwards and enters the camera, while light passing through the upper portion is bent downwards, and falls still further than before from the boundary of the opaque screen. If the camera is focussed on this region of greater density, the lower part (that is the upper in the camera, the image being reversed), will be illuminated, while the upper portion remains dark.



Diagram—Fig. 1.

In working the method, the source of light and its image on the diaphragm must necessarily be of finite width, and the adjustments are made so that a certain fraction of the width of the image falls on the screen, while the light from the remaining portion passes through the lens and gives rise to a uniform field. In these circumstances the upper part of the region of greater density would appear dark against a light field. The sensitiveness of the method depends on the relative proportion of the light stopped by the screen, and the light that enters the lens. For photographic purposes there must be a moderate amount of light to produce any effect even with the most sensitive plates, so that eye observations are considerably more sensitive. When it is desired to view the disturbances directly, the camera is replaced by a telescope, or the image formed by the camera lens is examined by a suitable eyepiece.[1]

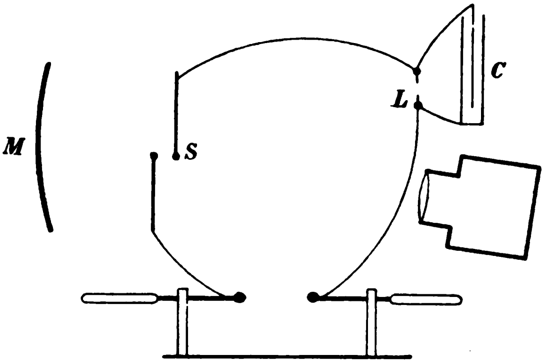
THE PHOTOGRAPHY OF SOUND WAVES.

Having described the manner in which disturbances in the air can be rendered visible, we proceed to consider some of the applications of the method, and select first of all one of the most striking and important, the examination of sound waves. Strictly speaking, the waves here spoken of are not sound waves at all, but the waves of compression set up by sudden electric discharges. They were investigated by Toepler more than thirty years ago (Wied. Ann. cxxxi. p. 33), and within the last few years a large number of photographs, illustrating the manner in which they undergo reflection and refraction, have been taken by Mr R. W. Wood in America. (*Phil. Mag.* xlviii. p. 218, l. p. 148.)

---

[1] A somewhat curious effect is observed with the optical arrangements just described, which might form the basis of an optical illusion. If the eye is placed close behind the back of the camera (the ground glass screen being removed), the source of light, with the apparatus for producing the light, is distinctly seen, but when an eye piece, focussed on the back of the camera is employed, the apparatus for producing the disturbances in the air is seen, with the mirror as a background. In the former case the eye sees the real image of the source just in front of the lens, and so close to it as to be practically unaffected by it, while the image which can be seen with the aid of the eye piece is so near the eye as to be invisible.

The arrangement of the apparatus is shown in Fig. 2. At the lower part of the diagram are the terminals, which supply an electric current at a high potential. The source of the current may be either an induction coil or an influence machine. From one terminal a wire is led to the spark gap placed in the path of the light travelling from the mirror to the camera. It is this spark which gives rise to the wave of compression to be observed, for convenience it may be termed the sound spark. The terminals are brass balls ⅝in. in diameter, and they are placed one behind the other, so that the light from the spark may not enter the camera. From this spark gap a wire is led to a second, which serves as the source of illumination, and is therefore provided with magnesium terminals. The circuit is completed by a wire from this point to the second terminal of the electrical machine. It is necessary that the light spark should take place somewhat later than the sound spark, in order to give the sound wave time to travel a sufficient distance from the terminals to be observed. To effect this a condenser is placed in parallel with the light spark, so that the light spark is delayed by the time necessary to raise the potential of the condenser high enough to spark across the gap.



Diagram—Fig. 2.

The photograph (Plate I., Fig. 1), is a view of one end of the laboratory, showing the light spark in a wooden box on the left, and the camera with its adjustable stand on the right. On the table are two of the large Leyden jars used to delay the light spark. Figure 2 shows the opposite end of the room, with the concave mirror resting in its case. It was originally designed for the mirror of a reflecting telescope, and has a radius of curvature of 30 feet 3 inches. Its diameter is 18 inches. In front of the mirror is seen the sound spark gap, and on the left is the large induction coil sometimes used as the source of electrical energy. At other times a large Wimshurst machine was employed. Toepler's observation that the influence machine gave more constant results in delaying the light spark was confirmed in the course of the work. But this is not altogether an advantage, as it is desirable to obtain as many stages as possible in the progress of the wave.

The velocity of the waves produced is probably greater than that of an ordinary sound, but taking it as 1,000 feet per second, the time required to traverse the diameter of the mirror would be ·0015 second, so that the time by which the light spark is delayed would be measured in ten thousandths of a second.

A number of photographs were taken, illustrating the reflection of a sound wave at surfaces of various forms. Some of these are reproduced in the illustrations accompanying the paper.[1]

Plate II., Fig. 1, shows the field of the mirror, with the terminals for the sound spark.

Photographs showing reflection from a parabolic surface are given in Plate II., Figs. 2 and 3. The spark gap was placed at the focus of the parabola, which was bent out of a strip of zinc four inches broad. The focal length was two and a half inches. In this case the reflected wave front is a straight line. It will be seen from the photographs that the wave front retains this rectilinear form in its passage across the field.

The illustrations in Plate I., Fig. 3, and Plate II., Fig. 4, are intended to show reflection from an elliptic surface The source of the wave being at the nearer focus of the ellipse, the reflected wave-front takes the form of a circle travelling towards the second focus of the ellipse. Both the direct and the reflected waves are seen in the photographs.

The effect of a diffraction grating is exemplified in Plate II., Fig. 5. The "grating" is constructed by attaching a number of mica strips, four inches long and three-quarter inches wide, to two long zinc strips bent into the form of a semicircle. On reaching the grating the wave is partly transmitted, partly reflected. The latter is seen in the photograph in the form of a semicircle concentric with the grating. Close inspection shows that the wave front is built up of a number of little wavelets, each having its origin at one of the mica strips—a practical illustration of Huyghens' method of constructing a wave front. [The details are almost lost in the reproduction.]

---

[1] The original negatives are ⅜in. in diameter. They were enlarged to about three times this diameter for use as lantern slides.

The compression in one of these waves must be considerable compared with that due to an ordinary musical note. We may, perhaps, form a rough estimate of the amount of compression from the fact that the wave fronts are seen at least as clearly as the jets of carbonic acid gas which are described later. The refractive index of carbon dioxide is 1.000454, while that of air is 1.000294. Let us assume that the density of the compressed air is the same as that of carbon dioxide. According to the law of Gladstone and Dale, the ratio of the densities is the same as the ratio of the refractive indices less unity, that is, in this case the ratio of 454 to 294, or roughly, of 3 to 2. Thus, with these assumptions, the density in the wave front is half as great again as the density of the undisturbed air. The wave resembles that caused by an explosion rather than that due to an ordinary sound. It should be added that the waves can still be seen when they are much less intense than those which have been reproduced.

Several attempts were made to see the train of waves due to a musical note, but on consideration of the facts just stated, it is not surprising that they were all unsuccessful. The notes due to a shrill whistle and to a siren blown by a pair of foot bellows were both ineffective. The only plan that I can suggest is to borrow a steam siren from a torpedo boat. But to be at work in the same room with it would be a somewhat trying experience.

Although the means available did not suffice to produce a musical note of sufficient intensity to leave a visible record, it occurred to me that it might be possible to produce a train of waves by another method. The single wave-fronts which have been seen on the previous photographs, were due to the disruptive effect of an electric spark. If, then, we could produce a series of such sparks at equal intervals of time, we should obtain a corresponding series of wave fronts, and so be able to imitate the effect of a musical note—the number of sparks per unit time corresponding to the pitch of the note.

Nearly fifty years ago Lord Kelvin showed from theoretical consideration that, in certain circumstances, the discharge of a Leyden Jar must be oscillatory in character. The process of charging a condenser may be compared with the stretching of a spring with a weight, and just as such a spring when released may execute several vibrations before coming to rest, so the condenser when discharged may give rise to electrical surgings or oscillations of gradually diminishing intensity. These oscillations were first suspected by Joseph Henry from observations on the magnetisation of steel needles by Leyden jar discharges, but a more direct experimental proof of their existence was given by Feddersen who examined the spark of a condenser discharge by means of a rotating mirror. In this way the spark, if of finite duration, is drawn out into a band of light, and the separate oscillations may be distinguished.

The next photograph exhibited, taken some years ago by Lord Blythswood, showed a number of sparks whose images have been drawn out into broad bands by a mirror making 100 revolutions per second. In it the successive oscillations are clearly seen, although their intensity rapidly diminishes. Measurement of the negative showed that the period of the vibration was 400,000 per second. These sparks were obtained from eight large jars the capacity of each being the 240th part of a microfarad.

The frequency in this case was very great, but by increasing the inductance of the circuit by the insertion of coils of wire it may be diminished to so small a value that the oscillations give rise to an audible musical note. I had at my disposal a set of large coils of wire, and by using various arrangements of these coils in combination with one of the large Leyden jars I could obtain a note whose frequencies lay between the limits 7,920 and 1,800 vibrations per second, the wave lengths of the corresponding sound waves lying between 1·3 and 7·3 inches. If then each electrical oscillation sets up a condensation wave of sufficient intensity, we should expect to get a number of waves visible in the diameter of the mirror (18 inches).

It may be asked why should this electrically produced sound have been expected to give visible waves when a sound produced in ordinary ways did not do so? To this I should have replied that the disturbance due to the spark probably consisted of a series of pulses rather than a train of waves, so that the wave form in the former case would be composed of a series of isolated peaks, while in the latter it would be a smooth curve.

The question was tested experimentally by connecting the induction coils and jar between the terminals of the coil or influence machine and observing the waves produced. An unexpected difficulty then presented itself—the first wave was clearly seen but it was very small in diameter, resisting all attempts to coax it out from the terminals by adding more jars to the light spark In fact, after a certain point the addition of capacity seemed to produce very little effect.

A number of photographs were, however, obtained in which the first wave front had travelled to such a distance that the second wave should have been clear of the terminals. But in none of them is there any trace to be seen of a second wave. Thus as an attempt to photograph a train of waves this method too proved a failure.

Even as a failure the result is not without its interest as it brings out very clearly the difference in character between the first discharge and the surgings that follow it when the spark is an oscillatory one.

In the words of Professor Trowbridge, who has made a special study of oscillatory discharges.

"Photographs of powerful electric sparks lead one to conclude that a discharge of lightning makes way for its oscillations by first breaking down the resistance of the air by a disruptive pilot spark —through the hole thus made in the air the subsequent surgings or oscillations take place."

In the language of the modern ionic theory this would be interpreted by saying that the first disruptive discharge results in the production of a large number of free ions, and these ions offer an easy passage to the subsquent oscillations.

THE DISTURBANCES IN THE AIR DUE TO FLAMES.

I pass now to another branch of my subject—the application of the Method of Striae to the study of the disturbances produced in air by changes of temperature or changes in composition. Since the refractive power of a gas is proportional to its density, and that in turn depends on the temperature, the method will reveal the presence of any region in the air whose temperature differs materially from that of the surrounding atmosphere. Such a case arises in every flame; the products of combustion rise from the flame as a column of heated gas and this is revealed to the eye as a pillar of fire, or in the photograph as a pillar of cloud. The next photograph shows the effect due to the flame of a spirit lamp. (Plate I. Fig. 4; Plate II. Figs. 7 and 8.)

In order to impress the fact that what is here seen is not the flame but the heated gas rising from the flame, I arranged a small fan which can be set in rapid rotation, and so drive the hot gas all over the field of view. The photograph (Plate I., Fig. 5) shows the effect when it has been set rotating.

The flame of a Bunsen burner gives rise to a disturbance similar to that due to the spirit lamp, but more voluminous in character. (Plate II., Fig. 6). The peculiar spiral form in which the column of gas rises before breaking up into a cloud is very noticeable in some of these photographs of flames.

A number of photographs were taken of jets of gas issuing from a narrow orifice. In (Plate II., Fig. 10), the jet is formed by blowing heated air through a brass tube seen at the top of the figure. In Figure 11 on the same Plate, the jet consists of carbonic acid gas issuing from the generating flask. In consequence of its great density the gas begins to fall downwards soon after leaving the nozzle.

Several photographs were taken to show the mode of formation of a vortex ring of heated air. These rings were produced in the usual way by means of a box with an aperture in one side, and the opposite side formed of some elastic material. On giving this side a sharp tap, some of the enclosed air rushes out with the formation of a ring. In this case the air in the box was heated by placing a spirit lamp inside it so that the rings, being formed of hot air instead of smoke, were quite invisible save by the use of the method of striæ. Some of these photographs are reproduced and are very instructive as showing the way in which the vortex motion is produced. The air appears first of all to issue from the orifice in the form of a column, but the tail is gradually left behind while the whirlpool motion of the head is accentuated. Finally little is to be seen but the section of the ring itself, the spiral structure being strongly marked. (Plate I., Fig. 6; Plate II., Figs. 12 to 15). In some cases a circular, in others an elliptic orifice was used.

The appearance of some of these photographs showing vortex motion strongly recalls the published photographs of the nebulæ of the heavens.

[The illustrations accompanying this paper have all been reproduced from silver prints. Those in Plate I. were prepared from the enlargements used as lantern slides: they have not been retouched in any way. The smaller figures in Plate II. are slightly larger than the original negatives. In several of these some retouching was found necessary to preserve the detail. I cannot but thank those concerned for the careful manner in which the work has been done.]

In conclusion I must express my great indebtedness to Lord Blythswood for the facilities for carrying out this work and the great interest which he has always shown in it.

PLATE I.

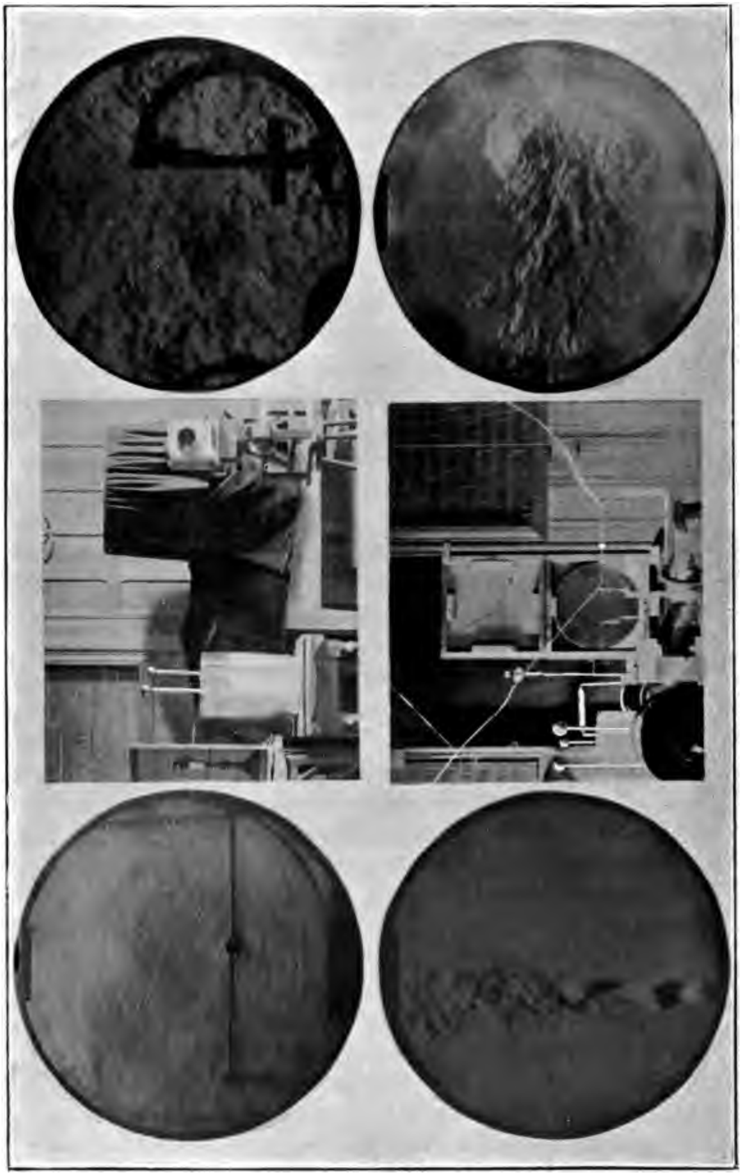
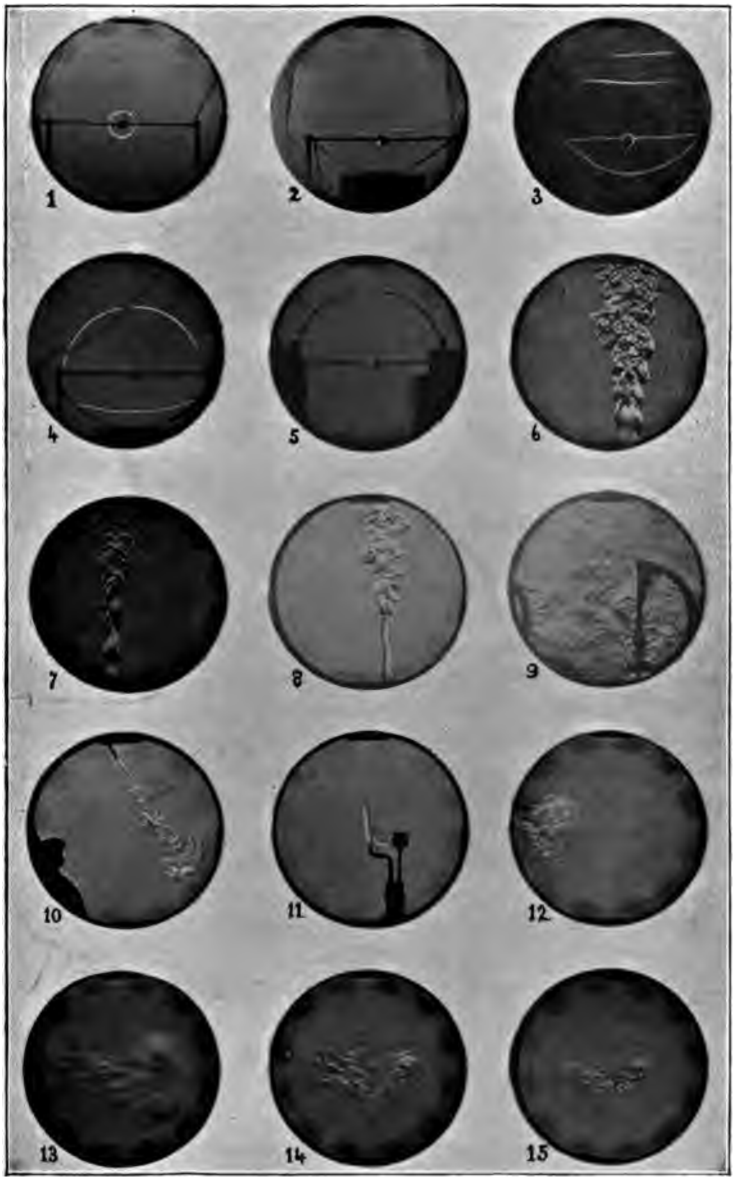


PLATE II.



IV.—*The Relation of Economics to Numismatics.*

By W. W. CARLILE, M.A.

[Read before the Society, 8th January, 1902.]

IF we glance down the pages first of any work emanating from the dominant school of utilitarian economists, and then of any numismatic work or periodical, we will certainly rise with the impression that their respective subject matters are very wide apart—and yet it is obvious on the surface that there must be many points of contact between the two. The economists tell us, indeed, with a surprising degree of unanimity, that[1] money is the most insignificant thing within the whole range of economics. None of them, however, so far as I am aware, have yet ventured to ignore its existence altogether; and whenever they find it necessary to deal with it, to treat of its origin, of its varieties, of the substitution of one form of it for another in the world, or in any given country, they tread inevitably the same ground as that which is necessarily trodden by the numismatists. How then is it that the points of contact between the two sciences have been so little recognised? How is it that we so seldom find an expert in the one who appears to have paid any attention to the subject matters of the other? We shall understand that better if we enquire how the first great question connected with money, the question of its origin, is dealt with ordinarily by the economists. They generally, in this country, at any rate, accept without hesitation the version of the matter to which Adam Smith has given currency. Men in an early period of the world's history, we are told, produced—more or less as they do now—a manifold variety of commodities, and each man soon came to desire to exchange his ware for that of someone else. After direct barter, however, had lasted for many generations, mankind, finding at length the inconvenience of the system, fixed by agreement among themselves on one substance which every one should receive in exchange for his wares, called it money, and finally impressed it with the stamp of authority so that it might universally pass current. This version of the matter is as old as Aristotle,[1] but certainly, as M. Babelon the leading numismatist of France remarks, not even the authority of Aristotle can avail to make it acceptable in the light of modern science.[2] To the mind of anyone who has given even a superficial degree of attention to the problems of ethnology, it must certainly appear as suspect on its very first presentation. It bears a too striking family likeness to the explanations of the origin of civil government, and of language, which were considered quite good enough a century ago, but which the progress of critical investigation has now-a-days rendered obsolete.

---

[1] Cf. Mill Prin. Pol. Eco., People's Ed., p. 296.

Civil government rested, we used to be told, on the famous Social Contract between King and People entered into some time at the dawn of history. Language and money were alike the result of conventions entered into among themselves by primitive mankind. Two things, however, we may always take as certain, remarks the German ethnologist, Schurtz, with regard to the institutions of early man; first, that nothing has come into existence suddenly, but that, on the contrary, everything has roots that are traceable in some pre-existing state of development; secondly, that nothing is ever done by the community with a conscious intention of attaining the end which at a subsequent period is found to have been attained.[3] Such versions of the origin of government, of language, or of money, are plainly closely akin to the aetiological myths which historical enquiry has been busily ousting from their domain during the last hundred years. As the mythopoeic instinct of the Romans, finding themselves in possession of a city named Roma, proceeded at once to account for the fact by the creation of a hero named Romulus, who founded it, so the mythopoeic tendency of uncritical philosophy, seeing the world in possession of such institutions as government, language, and money, proceeds without more ado to construct an origin for them in impossible and inconceivable conventions and agreements.

If we drop the conception of a convention and resort to serious investigation of facts, we find that it is either to the numismatists or to the ethnologists that we have to look for any light that has been shed on the subject. Properly speaking, of course, the scope of numismatics does not extend beyond the origin of coined money, and the very interesting questions connected with the origin of the use of the precious metals uncoined as money, hardly come strictly within its sphere. Incidentally, however, M. Babelon in France, and Professor Ridgeway in this country, have dealt with that question from the numismatists' point of view in an enlightening manner. One thing that comes out very clearly as a result of their investigations is the conclusion that the last thing that is likely to become money in any country is wheat, or any of those things that are necessary to sustain life or to satiate immediate bodily needs, but that, on the contrary, the things that have become money, and that have achieved for themselves a wide range of currency in the world have been shells, beads, bronze, gold and silver, things that appealed to the apparently frivolous fancy of early man for his personal adornment. The same conclusion has been arrived at, and is sustained by a convincing array of facts in a recent work by a German investigator, Dr Heinrich Schurtz of Bremen. (I am indebted to Professor Marshall of Cambridge for drawing my attention to this important work.) "From the whole history of the development of money,"[1] says Dr Schurtz, "the conclusion comes out that it is only exceptionally that it embraces objects of pure practical use, and last of all the immediate necessities of human existence, the various kinds of food."[2]

---

[1] Politics, I. 6.

[2] *Notice sur la Monnaie*, p. 26, from the *Grande Encyclopedie*, *t. xxiv.*

[3] Grundriss einer Entstehungs-geschichte des Geldes, p. 5.

This surely is a conclusion well worthy of the attention of the economists. There is, after all, a world embracing solidarity between the institutions of primitive man and those of civilised man. A certain class of theorists, and in this country a very influential class, are never done insisting that corn, perhaps, or, in the more modern form of the conception, that index numbers representing largely foodstuffs and clothing, ought to be the standard of value for the world, while, at the same time, mankind goes on using as its standard of value a substance of very little practical utility, and one whose attraction lies ultimately in the appeal that it makes to æsthetic fancy. Yet Nature is wiser than the theorists. It needs little consideration to satisfy ourselves that corn and the like could never have become money, and could never have measured values. Adam Smith, in his account of the origin of money, tells us, in so far with truth, that the prudent man would endeavour always to have by him "a certain quantity of some one commodity or other, such as he imagined few people would be likely to refuse in exchange for the produce of their industry,"[1] and that this commodity would eventually become the money of the community. Neither corn nor any other description of food could ever be that commodity, and for this reason, because once a man had as much food as he could eat, or could conveniently store, he would take no more of it at any price, he would barter away none of his products in exchange for any of it. While, on the other hand, gold *par excellence* the material of ornament, and ultimately because it is the material of ornament, is never refused, no matter in what quantities it is offered. It possesses the one great and indispensable characteristic of the monetary commodity, universal acceptability.

---

[1] "Binnengeld." Dr Schurtz, however (p. 62), thinks "Binnengeld" the main root of money generally.

[2] Op. cit., p. 134.

The great mistake made by the utilitarian economists lies in their assumption of the predominating rationality of the human beings which are the subject of their investigations. It is to this false assumption that the reputation of their science as the dismal science is mainly due. The true science of man, in any of his varied aspects, is never dull and uninteresting. On the contrary, it is always full of unexpected turns and curious surprises. The fact that the frivolous fancy for ornament should have laid the foundation on which the genius of the race has reared, in the long run, the great structures of money, commerce and credit, has many parallels. As Emerson remarked, the magnet was used as a toy long before it was used in navigation. Professor Karl Bücher of Leipsig has shown that what we call work in the human race all began with play, mostly to a rhythmical accompaniment.[2] For untold generations the *genus homo* no more worked for his sustenance than did his Simian neighbours. He picked up what he found to hand, and when he could find nothing he went hungry. When at length he did begin to work, his first labour was not devoted to the procurement or preservation of food, but to the tatooing of his body or the decoration of his weapons. An immense stride, as we know, was made by early man in the path of progress when the ox and the sheep were domesticated; but nothing is more certain than that neither of them was domesticated in the first instance for the sake of their uses as providers of food or clothing. In innumerable instances in primitive societies, such animals are tamed, and yet no use whatever is made of them. Even the pig in Oceania was tamed apparently, at first, solely for the pleasure of his company. The little pigs are often still petted and fondled by the whole family, and not infrequently suckled by the women.[1] It was only as an afterthought, as a step in the direction of civilisation, or perhaps of cannibalism, that his flesh came to be used as food in the first instance, at festivals, and in the long run generally.

---

[1] Wealth of Nations, I. 4.

[2] Die Entstehung der Volkswirtschaft, p. 32. Cf. also "Arbeit und Rhythmus," Leipsig, 1899, by the same author.

In tracing the history of money, even at a later period, we should be greatly in error if we were to confine our attention to its employment in the purchase of utilities. It must surely come upon us as a surprise to find that the greatest of all agents in connection with its development for innumerable generations was religion. Dr Curtius has shown in a very striking article, which has been translated by Dr Head in the "Numismatic Chronicle,"[2] how intimately the spread of commerce along the coasts of the Aegean was associated with the worship of Aphrodite Urania. Whenever a Sidonian factory was established, the centre about which it grew was the shrine of that goddess. "The gods," as he says, "were the first capitalists of Greece," and certainly if we wish to understand the beginnings of the growth of accumulations of capital in the world, a fact fraught with such immense significance for its subsequent progress, it is rather to religion and to warfare than to industry of any sort that we have in the first instance, to turn our attention. The sacred character that attached to money throughout the classical period and in Spain[3] and the East, at any rate far down into the Middle Ages, is a fact very familiar to the numismatists. The heads on the Greek coins up to the time of Alexander are, without exception, the heads of deities, and the symbols on the reverse are, for the most part, symbols connected with their worship. Alexander's head had to be, in the first instance "in a manner smuggled in, a profile being given of the divine ancestor of the race which bore a resemblance to the reigning descendant."[1] The majority of the coins that bear his image, however, were struck after his death and his deification. The Ptolemies and the Roman emperors were, of course, as we know, at once gods, the object of religious worship, and civil rulers. Indeed, legitimate sovereignty and deification seemed closely associated in the human mind at that period of the world's history.

---

[1] Op. cit., p. 62.

[2] N. S., X. p. 91.

[3] M. de Vienne, Rev., Num. 3^e Ser., tom XI., p. 375.

If we look for the source of this intimate association between religion and money, we shall find it, I think, in the connection between money and ornament. No doubt ornaments were themselves originally very frequently regarded as something sacred, as possessing the character of amulets.[2] To early man everything was living and full of mystical powers and occult faculties. At a later period an out-growth of the same sentiment that has led, and that still leads men and women to devote so much of their energies to the adornment of their own persons, led them to devote similar energies to the adornment of their divinities; and I think it is very interesting to observe how closely parallel were the ultimate developments of religious to those of personal adornment. It is a familiar observation to those who have paid any attention to the customs of the Hindoo, or, generally speaking, of the oriental peasantry that their capital is often, to a large extent, carried in the rings and bracelets and necklaces of their women. At a certain stage of culture it could be carried in no other way. If it were there, present in ready money it would infallibly be at once expended. In ordinary times the use of the ornaments is to confer social prestige. If the crops fail, however, then they are a resource in utmost need. At first, no doubt, it is their primary purpose that is alone considered. At a later stage, however, their secondary purpose also begins to enter into the thoughts of their wearers. The women of the tribes on the borders of Thibet are always ready to use portions of their silver ornaments in making their purchases. At the same time, whenever they get any money the first thing they do is to buy more ornaments with it. The ornaments are thus their medium of exchange and their store of value. In the early Teutonic period similarly, before money proper, at any rate among the races that were far removed from the confines of the Roman Empire, could be said to have come into existence, there was undoubtedly a circulation of ornaments that closely foreshadowed the circulation of money. A title of honour for a king was a "Ring-breaker," meaning a free-handed distributor of treasure, in as much as he was supposed to be always willing to break off portions of the golden armlets that were so much worn, and so highly valued by our ancestors, and to present them to the members of his *comitatus* and to the bards who sang his praise. As then, the ornaments of the individual became his private capital, so the ornaments of the divinity became the national treasure, and came further, in course of time, to be consciously recognised as such. We see the transition of use fairly accomplishing itself in the great period of Athenian history. At the outbreak of the Peloponnesian War, when the Spartans were on the frontiers of Attica, Pericles had occasion to endeavour to reassure his countrymen with regard to the extent of their resources. After giving an estimate of the amount of the tribute due from the allies and of the coined silver stored in the citadel, he remarked that besides this they had gold and silver uncoined both in public and private repositories; they had many valuable vases destined for religious uses and for use in the public solemnities. "He mentioned further," says Thucydides (II. 13) "the great wealth that was stored up in the various temples, which they had a right to use; and if this should be denied to them he said they might have recourse to the golden ornaments of the goddess herself. He declared that her image had about it to the weight of forty talents of gold without alloy, [that is to the value of about £100,000];[1] all which might be taken off the statue. He maintained that for the preservation of their country it might be lawfully employed, but added that it ought afterwards to be amply replaced." Hecatæus, the historian, it may be remembered, as Herodotus tells us, (v. 36), gave advice precisely similar to the Milesians with regard to the treasures in the temple of Apollo at Branchidae when the siege of their city by Harpagus was threatened. His advice was not followed. Miletus was taken and the treasure fell into the hands of the Persians. In the very nature of the case, thus it is apparent, that there must of necessity in such cases have arisen an identity of interests between the State and the Divinity and, consequently, it could not be regarded as impiety to use, in the last resort, treasures which were necessary for the protection of the deity herself no less than of the city over which she presided. In Athens thus we find that the custody of the treasure of Athene was taken out of the hands of the priesthood, probably as early as the time of Pisistratus,[1] and that, by the close of the fifth century before Christ, all the sacred treasures were vested in the board of ten chosen annually by lot to safeguard the public wealth generally.[2]

---

[1] Num. Chron. N.S., X.

[2] Schurtz, Op. cit., p. 41.

---

[1] Boeckh, Pub. Econ. of Athens, p. 447.

This connection between religious worship and the accumulation of capital is very far from finding its first manifestation in the field of Greek history. Dr Curtius' remark that the gods were the first capitalists of antiquity finds abundant illustrations in the records of the Babylonian tablets. A credit system presenting in many of its features an approach to our modern system seems to have built itself up in Babylon on the basis largely of the sacred treasures.[3] We are told, for example, of a woman in the reign Samsu Iluna about 2,000 B.C., who was a devotee of the Sun-god, and who entered into partnership with two men in order to trade with a *maneh* of silver which had been borrowed from the treasury of the god.[4] The treasury of the god was apparently thus the bank of Babylon.

To readers of Greek history other cases of the coining down, actual or suggested, of the golden or silver statues or ornaments of the gods will occur besides those alluded to. In the late Hellenistic period, 123 B.C., we are told that Alexander Zebina who had usurped the throne of Antioch and was besieged there, came into the temple of Jupiter and, seeing there the god holding out on his extended hand a statue of Victory said, with discreditable profanity, "I accept the victory you offer me," and thereupon took down the image and had it coined into money. The story is no fable, at any rate as regards the general facts it embodies. Quite recently M. Babelon has lit upon some gold coins of Zebina of the very year in question, and the significant thing is that this gold is the only gold coined in Antioch, at any rate for a hundred years before and a hundred years after the brief reign of the usurper.[1] On this occasion the interests of the Crown and those of the divinity were not looked upon as being sufficiently identified, and Zebina was driven out of the city by the populace.

---

[1] Num. Chron. N.S., X. p. 108.

[2] Boeckh, Public Economy of Athens. Sir G. C. Lewis' translation, ed. 2, p. 160 ff.

[3] See F. Le Normant, La Monnaie de l'Antiquité, Vol. I., p. 117 ff., *re* Babylonian Bills of Exchange.

[4] Sayce. "The Babylonians' and Assyrians'" Life and Customs, p. 128.

The subsequent history of the Athenian treasure referred to by Pericles in the speech above quoted is worth following as it illustrates some interesting aspects of the mutual bearings of economics and numismatics. Twenty years after the inception of the war the amount still unexpended was one thousand talents. A talent is usually estimated in our modern money as the equivalent of something between £240 and £250. Owing to the change of standard in the world from silver to gold, it is quite impossible to make such an estimate exact. £245 is probably as near the mark as we can come. The total amount of the treasure was thus what would be from the modern statesman's point of view, the mere trifle of £245,000. Yet what did it effect? It went near changing the whole course of Greek history. When the city finally resolved to make use of the treasure it was in the last extremity of danger and distress. The news of the disasters in Sicily had arrived; the allies were one after another revolting, and nothing but the slackness of the Spartan admiral had prevented Athens itself from being occupied by the enemy. The treasure was sufficient, however, to equip a fresh fleet, to render possible the conspicuous, though short-lived, triumphs of Alcibiades in the Hellespont, and the partial re-establishment of the Athenian empire; as well as to enable the war to be carried on for another eight years before the arrival of the fatal day of Aegospotami. Writers who base their estimates of the relative power of money in ancient and modern times mainly on the average prices of corn in the two periods respectively, tell us sometimes that a talent of silver would go three times as far, sometimes that it would go ten times as far in the Athens of Pericles as it would to-day. Both such estimates I think are altogether inadequate and misleading. A thousand pounds must, from the point of view of national, and thus of personal security, have loomed larger in the eyes of an Athenian, than a million does in ours. It must be remembered too that war was always, in Greek antiquity, both an infinitely more imminent and an infinitely graver consideration than it is with us. Defeat in battle might mean, as likely as not, death or slavery for the whole population ; while, at the same time, a citizen of Athens was never out of sight of actual or possible enemies. At one period there was Aegina, "the eyesore of the Piraeus," always ready to aid and abet an invader; at another there was Deceleia, with its Spartan garrison, only twelve miles away, in the interior. In such circumstances money would surely take its value in the minds of men very largely from its military importance.

---

[1] Discours de M. E. Babelon, sur l'utilité scientifique des collections des monnaies anciennes. Rev. Num. 4^e Ser., Vol. I., p. 216.

If we take into consideration this fact of the great importance in Greece of what would seem to us small sums of money, we have, perhaps, an explanation of the other fact that, though gold and silver were both largely in use from the earliest times, it appears to be quite certain that gold never supplanted silver as the standard money. It certainly did not supplant it anywhere in the Greek world before the period of Alexander, though it is possible that it did so in the empire of the Ptolemies. Adam Smith, observing that, in his own time, gold had become the metal that regulated the value of the whole coinage, or, as we should say, the true standard, and that it had become so without any conscious intention on the part of the State to make it so, arrived at the remarkable generalisation that, when two metals are circulating together at a fixed ratio, the most precious of the two will always assume the rôle of the regulating metal, and relegate the other to a subsidiary position.[1] His law finds many striking and interesting illustrations in the history both of ancient and of modern money. We can see in Republican Rome, silver, the more precious, ousting the less precious, copper, from its position as standard, and taking its place; and again, we can see in Imperial Rome and in mediæval Europe, gold similarly ousting silver and becoming itself the standard. Why did it not do the same in Greece in the fifth and fourth centuries before Christ? Possibly for the reason that I have suggested, that silver appears then to have been a metal that was in truth immensely more precious than even gold is now. The smallest silver coins then would not have been so insignificant as not to be worth weighing and testing when passed from hand to hand ; and, in such circumstances, they could hardly become subsidiary money circulating at a nominal value only.

In these last paragraphs I have touched on the second of the obvious points of contact between numismatics and economics,

---

[1] Wealth of Nations, I. 5.

i.e., their respective bearings on the questions connected with the transition of standards in the world. The conditions of my space however, forbid me to dwell at length on this point. It is in the great numismatic work of Mommsen, his History of Roman Money, that the only attempt that I know of is to be found, at a scientific explanation of the causes which led in Rome first to the supersession of copper by silver as standard money, and afterwards to the supersession of silver by gold. Both transitions present numerous interesting points of comparison with the various stages of the great transition from silver to gold in mediæval and modern Europe, of which the final stages are accomplishing themselves under our eyes.

In closing I may say just a word as to the other inducements to the study of numismatics, which may weigh with those whose literary and speculative interests lie elsewhere than in economics. Coins, it has well been said, are the living eyewitnesses of historical facts; "they not only verify but they also vivify history." There are, indeed, whole fresh regions of history that they have, for the first time, laid bare to us. Who would have believed, had it not been for the evidence of the coins, in the existence of a Greek empire in India hardly less populous than the empire of Alexander himself.[1] The strange thing too is that it was founded in the period which we are ordinarily accustomed to think of as the period of Greek decadence; it only rose to the height of its power after the sack of Corinth by Mummius and the reduction of Greece proper to the *status* of a Roman province. "The great Emetrius, the King of Ind," of Chaucer's Knight's tale is, as General Cunningham tells us, no fabulous hero, though his name was really the more familiar one of Demetrius. His coins present us too, it must be said, with the noble features and lofty bearing with which tradition has credited him.

For the study of numismatics Glasgow is in possession of an exceptionally rich resource in the Hunterian collection. It cost Dr Hunter, at the end of the eighteenth century, some £25,000, and the value of ancient coins has risen very greatly since that date. For a long period it lay practically dormant. That reproach is however of late years being removed, at any rate as regards one important part of the collection, the Greek coins. They are being catalogued and thus made available for purposes of scientific study. The cost of publication is being borne by a liberal-minded citizen, Mr James Stevenson of Largs. The work is being carried out by Mr George Macdonald, and in a manner that has been universally regarded as satisfactory by other numismatic experts. It remains for some others of our wealthy citizens to furnish funds for the cataloguing of the rest of the collection, and, perhaps, also for the display to the general public of at any rate the most important of the coins.

---

[1] Coins of Alexander's successors in the East, by Major General A. Cunningham. Num. Chron. N.S., X, p. 223.

V.—*The Criminal: Some Social and Economic Aspects.* By W. Miller Douglas, Superintendent, Marine Division, Glasgow Police.

[Read before the Economic Science Section, 29th January, 1902.]

The study of the criminal is not popular in this country. He is evidently considered a person to be kept constantly at arms length, and only becomes interesting when touched with the genius of a Conan Doyle; even then the interest is generated by his discomfiture at the hands of the Sherlock Holmes, who successfully combats his criminality; not by the vicissitudes of his life-history, which, perhaps, produced that criminality. The average individual consoles himself that he has done all that is necessary for the community, for himself, and for the unfortunates who pass through our penitentiaries and prisons, when he pays his police rates, his burglary insurance premium, and his contribution to the Discharged Prisoners' Aid Society. Such is an extremely restricted and faulty view of personal and civic responsibility, and any advance in the methods for the prevention of crime and the reformation of the Criminal will be dependent to a large extent on the ascertainment of fuller information of the questions at stake by the citizens of this country, and the consequent formation of broader and more enlightened views. It has been said that the lessening of the crime of a country is an object of the best thoughts and the best efforts of the best men. But in the preface to an English book on "The Criminal," in 1890, the author states that, "no book, scarcely a solitary magazine article dealing with this matter has appeared among us in this country." Since then a little more activity has been shown, but the native sources from which reliable information can be got are still not numerous. Havelock Ellis in "The Criminal" has treated the subject from a scientific point of view and has collected a mass of material, principally from other countries, showing how the science of criminal anthropology has been and is being developed. Sir E. du Cane, an English Prison Commissioner, and W. D. Morrison and J. W. Horsley, prison chaplains, discuss the causes and cures of crime from a prison stand-point. Mr Tallack, secretary to the Howard Association, in his "Penological and Preventive Principles," approaches the subject from a philanthropic point of view, while police views are presented by Sir Robert Anderson, lately chief of the Criminal Investigation Department, London, in articles in the "Nineteenth Century Magazine" of February, August and November, 1901. As showing the apathy of scientific men, and men otherwise interested in the problem of the Criminal in this country, it may be mentioned that although a Congress on Criminal Anthropology has been held in various Continental cities at intervals since 1885, Great Britain was first represented at the Amsterdam Congress in September, 1901. In 1889 the International Association of Criminal Law, was founded by Professors Van Hamel of Amsterdam, Liszt of Marburg, and Prins of Brussels. England is represented, but in number only equals the Portuguese, Servian or Argentine representatives. The Association represents, from the scientific and practical standpoint, the movement of reform in matters that relate to the Criminal, and is therefore worthy of support. When a stray article does appear in a newspaper or magazine its reasoning is frequently as inscrutable as its object. One appeared recently in a weekly magazine of repute, and the writer after endeavouring to show that criminals were supporting a large army of policemen, prison warders, judges, lawyers and ministers, who would otherwise starve, concluded with the startling declaration:—"Were every one honest all the bills, contracts, promissory notes, and all the costly provisions instituted to safeguard the interests of the unwary, would disappear. The conclusion therefore is obvious. Crime and Criminals are so necessary to the well-being of society, that were goodness to become too common we should have to manufacture Criminals to save a number of trades from extinction, and thousands of deserving people from the horrors of poverty."

I mention these instances of general apathy in regard to this important problem, as constituting in themselves a most remarkable social fact. They seem to indicate a popular feeling of impotence to face the problem, or to indicate the existence of the fatal gift of complacency.

Compared with other countries, Britain is far behind in the scientific study of the individual and social factors of crime. Indeed two new sciences have been evolved from the results of the investigations of continental students of the subject.

Criminal Anthropology is the natural history of the Criminal man. It studies him in his organic and psychical constitution, and in his life as related to his physical and social environment. This science is really the creation of Professor Lombroso of Turin, who gave a scientific form to sundry scattered and fragmentary observations upon criminals, and added fresh life to them by a collection of enquiries, which were not only original but also governed by a distinct idea.

Criminal Sociology deals with the social phenomena of crime and criminals, and with the social arrangements for repressing anti-social conduct. It seeks to describe these phenomena in an orderly way; to explain them by causes, and to deal with them according to regulative principles discovered in and approved by experience.

A perfect library of literature on these sciences has emanated from the Continental and foreign press within the last fifteen years. Among the investigators are Lombroso, Ferri and Garofalo of Italy, Tardé, Brouardel, Lacassagne, Garnier and Albanel of France, Krafft-Ebbing, Krauss and Benedikt in Germany, Salillas in Spain, Van Hamel in Holland, Quetelet in Belgium, Drill and Tarnowskaia in Russia, Dr Del Drago in the Argentine Republic, and Senor Falcon in Cuba. In the United States M'Donald, F. H. Wines, Dugdale and Henderson have all studied the subject in a methodical and scientific way; in Canada and Australia it is not only studied, but some of the lessons deduced from the study have been practically adopted. This universal activity accentuates our apathy and renders our position in regard to an important and ever-present problem difficult of explanation. It may be broadly stated that the individual commits an anti-social act, either from some qualities, hereditary or acquired, peculiar to that individual, or from the social conditions surrounding him, or from a combination of both causes. *Here* little or no effort is made to discover the personal or social causes conducive to crime; *in other countries* laborious investigations have been, and are being made, to discover these causes. In the domain of health, sick patients are treated, but beyond that the causes which produced the sickness are sought for and eliminated if possible. In the field of crime, the criminal is dealt with for his offence, but no diagnosis is made to ascertain the causes which evolved the criminal.

A necessary preliminary in the search for improvement in method, must be a knowledge that the method in existence is faulty and unsatisfactory. I therefore wish to say a few words on the objects sought to be attained in dealing with criminals, the means used to attain these objects and the results. In every community of individuals there grow up in connection with the manner of living and with the trades and commerce carried on, certain customs. These customs are based on communal duties and come to be respected and observed as regulating the conduct of all in their domestic, civic and business life. The simpler the social life the less necessity there is for regulative customs. But social complexity demands much regulation, and thus it is that we find in our own country legislative enactments innumerable, for the control of almost every conceivable branch of human activity. These laws are the expression, in authoritative form, of the belief that certain kinds of conduct are hurtful to the common interest. The existence of laws for the regulation of human conduct and action implies that there is a certain number of citizens who do not conform to the recognised standard of conduct, and who require to be told that infraction of the law will involve unpleasant consequences. The object, therefore, that society has in providing a social mechanism for preventing anti-social conduct, is its own protection; and to the criminal law belongs the duty of working that mechanism for effecting its exclusive object. Those who do not observe the laws are termed criminals, using the word "criminal" as a person who endures a penal sentence. Naturally the first questions that arise in connection with the study of the phenomena of anti-social conduct are: Who are the criminals? Is there anything to distinguish them from law-abiding people, or from each other? Are they normal beings? The starting point for such an enquiry is the determination of a normal type, physically and psychically. One of the latest writers on the subject says:

"The physical type preferred by each race may be supposed, generally speaking, to represent the form and condition, adapted on the whole to the environment of that race.

"The power to adjust one's thinking, likes and choices to his natural and social environment, is a mark of normal psychical action."

Dr Mercier, a leading authority on insanity, says that insanity is "a disorder of the process of the adaptation of self to its circumstances," which coincides with the opinion above expressed.

Criminals do not adjust themselves to their environment, hence the contention of certain scientists that they are abnormal beings. Lombroso and the Italian school insist upon a criminal type of man, and they support their opinions with weighty arguments, and the results of much experiment; they even subdivide the type into classes corresponding with several varieties of crime. On the other hand, Dr Garnier of Paris, M. Drill, Counsellor of the Ministry of Justice at St Petersburg, and many others, assert as positively that there is no criminal type—no born criminal. Crime, they say, is one of the accidents of life. Professor Brouardel of Paris seems to state the question very fairly when he says: "Crime should not be regarded as the result of any single isolated cause, physical, moral, or social, but of all those causes at once. The diagnosis of the criminal must be subordinated to the same rules as the diagnosis of a disease; that is to say, it is made up of related and simultaneous conditions." In justice to the Italian school, it may be stated that they do not crave for the application of the data of criminal anthropology to all who commit crimes. Professor Ferri confines them to a certain number who may be called congenital, incorrigible and habitual criminals. Besides, criminal anthropology does not step in and determine the responsibility for a crime. The only legitimate question which can be put to it, according to Ferri, is, "Is the criminal, and in what respects is he, a normal or an abnormal man? And if he is, or when he is abnormal, whence is the abnormality derived? Is it congenital or contracted, capable or incapable of rectification?" If, as is asserted by those who ought to know, although I have been unable to obtain statistics supporting the assertion, many feeble-minded and epileptic people find their way to prison, and become habitual criminals, there seems good ground for skilled examination of those charged with crimes to enable the disposing judge to appreciate the true relationship of the criminal to the crime. I should have made a reservation with regard to statistics, for in the Second Annual Report of the Certified Inebriate Reformatories, it is stated that 16 male and 128 female cases were admitted during the year. Some committals proved to be certifiable lunatics, and over 25 per cent. of the committals were mentally deficient. So long as the latter were drinking, their eccentricity and violence were ascribed to these habits; but after liquor was removed the real state of affairs became evident. Mention may also be made here of a resolution passed at the recent Anthropological Congress, on the motion of M. Albanel of Paris, recommending that children breaking the law should be examined before being brought into court, and if found to be degenerate, should be placed in special educational establishments. This indicates a tendency towards practical application of the idea of treating criminals in the way which will be most beneficial to themselves and to the community.

While the existence of a criminal type is a debatable question, all students are agreed that there are different classes of criminals. There is the criminal by passion, the criminal by occasion, the criminal by acquired habits, the instinctive criminal, and the insane criminal. It is difficult to estimate the relative numbers of each class. Ferri thinks that instinctive and habitual criminals are from 40 to 50 per cent. of the total, but of these two classes the instinctive criminals number only about two or three per cent. of the total. This estimate agrees with my own experience. Criminals by occasion and habit constitute the great majority of convicts.

Coming now to the second enquiry, viz., the means used to attain the objects sought for, they may be divided into two classes —correctional and preventive. The prison is the most conspicuous factor in the first, and merits first consideration. It stands high in general estimation as a correctional agency, and the popular way to dispose of any person guilty of any anti-social conduct is to suggest a severe sentence of imprisonment. But a knowledge of the results will, I am certain, lead to a revision of our exaggerated estimate of the prison as a suitable instrument of reform or deterrence. On the threshold of the enquiry one is met by the fact that there are grave differences of opinion as to the object of imprisonment. Sir Robert Anderson in the articles already mentioned, says: "Why do we imprison our criminals? The stock reply would be (1) to punish, (2) to deter, (3) to reform. The third point may be dismissed with the remark, that if the State is really responsible to reform its criminals, its methods are singularly ill-adapted for the purpose. And the State is no more bound to punish than reform."

Justice Wills, in a letter to "The Times," agrees with Sir Robert Anderson that the primary object of punishment (not imprisonment) is the protection of society, and that the reformation of the offender, though most important if it can be effected, is still only secondary to the primary object. The Chairman of the Scottish

Prison Commissioners said, "the work in prison was a work of punishment and reformation;" and the Chairman of the English Prison Commissioners, speaking of the American parole system, said, "In their hurry to release a man because it seemed to them from a diagnosis of his character, that he may be good in the future, they forget the man owes a debt to society, because he has been proved by the law to have been bad in the past.

In the remit to the Departmental Committee on Habitual Offenders in Scotland (1895), it will be found that the Committee were asked to suggest such remedies as may, while deterrent, be likely to bring about the reformation of habitual offenders, and prevent further addition to their numbers, and the Committee on Scottish Prisons in 1900 placed on record the following opinion: "In every system of State Punishment, the reformation of the criminal should be an object to be kept constantly in view."

This divergence of opinion as to the real object of the prison must be prejudicial to successful administration. It is impossible that satisfactory results can follow when the various related departments of police, judiciary and prisons, are not agreed upon what is the ultimate aim of the treatment of the criminal. Personally, I think the reformation of the criminal the most important of the three purposes mentioned, for if that is effected the security of society against the reformed criminal's acts is guaranteed, and a deterrent agent instead of a criminal propagandist introduced into the community. But it is essential that there should be a clearer understanding on this important point among those who have to administer the law, for difference of opinion as to the objects will involve difference of treatment of the criminals. Withal the work of the prison goes on in its ceaseless grind of human beings. In Scotland last year there were no fewer than 60,500 imprisonments representing 41,600 persons, the largest number ever committed in Scotland in one year. Two-thirds of the total imprisonments were directly due to drinking, and the average length of sentence was 15 days. The total number received into English prisons was 166,794 in 1900. When a criminal enters prison he enters a place of routine—becomes part of a huge machine. Regular habits are enforced; he washes, eats, sleeps and works according to a time table, he is not allowed to speak, his physical and spiritual wants receive careful attention. What are the results? These are best told in the words of prison officials themselves. In the evidence given before Lord Elgin's Committee on Prison Administration

(1900) some interesting opinions were elicited. The Chairman of the Prison Commissioners said short sentences were of no use, and that no system of punishment was satisfactory if there was not something of the reformatory in it, but could not suggest any improvements in the present system. He had done what he could to introduce a softening of anything like hard lines or crystallisation in the prison system. Sir Colin Scott Moncrieff, who was interrogating, said he could not see anything that savoured of reformatory in Peterhead. It was a terrible machine-like business. The Governor of Peterhead admitted that there was nothing of the reformatory in his prison, the object of the establishment being to deter from crime. When asked if he could recommend any measures with a view to reformation, he said that he could not. The chaplain of the same prison was not very enthusiastic in his opinions as to the good effect of his attentions. The Governor of Duke Street Prison on being asked if he ever felt he had been able to do anything in the reforming way upon which he could look back with pleasure, admitted that he had not. He looked to the chaplain. These are samples of the opinions given by many witnesses in the enquiry. It was also stated by one witness that of 32,017 persons committed to Edinburgh, Glasgow and Dundee Prisons during the year 1861, 1862 and 1863, 10,135, or 31·6 per cent., were re-committals within the same year. While of 106,367 committed to the same prisons in the years 1891, 1892 and 1893, 33,666, or again 31·6 per cent. were re-committals within the same year. These figures prove that imprisonment is not efficacious in deterring even the persons who endure it, and they further prove that short sentences are as effective in deterrent power as long sentences, for in the first three years the average imprisonment was 30 days, while in the last three years, 15 days. Lord Elgin's Committee stated, "that they expressed no opinion on the merits of systems of prison treatment such as those in the United States of America, which appear to aim more at improvement and less at mere restraint, but what we ourselves saw in the prisons induces us to hold the opinion that nothing but advantage would ensue if it were possible to modify our system in this direction, and encourage prisoners with long sentences to look forward to the future with some measure of hope and confidence. It is here we must look for the reforms of the future rather than to further improvement of the physical treatment of the prisoners."

The Committee on Habitual Offenders (1895) used much stronger language. They spoke of the "utter inadequacy of the present system in all the variety of detail which it offers to deter the habitual offender from a course of life which devolves the cost of his maintenance on the prison and the poorhouse when he is not preying directly on the public."

Mr Herbert Gladstone's Committee on English Prisons came to the same conclusion. They believed that, under the present system, numbers go out of prison as bad as, or worse than, when they entered it; that they go out with the prison taint on them; that the available prison staff and the rigid system of prison discipline, without any fault on the part of the officials, preclude the possibility of bringing to bear on the prison population, the moral suasion and the healthy, practical advice which they thought could be exercised by a trained and selected staff in the penal reformatory.

If unofficial corroboration of these views were wanted we might cite Oscar Wilde and Earl Russell, both of whom had practical experience. The former says it is not the prisoner, so much as the prison, that requires reformation. The latter believes that, to the ordinary prisoner, the present system was calculated to have a deteriorating effect mentally, and it was not calculated to give anyone self-reliance. This volume of opinion, which could easily be supplemented, demonstrates the inefficacy of the first line of social defence.

In addition to the power of imposing actual imprisonment there is power, under the Probation of First Offender's Act, 1887, to impose a sentence of liability to imprisonment contingent on the infraction of certain conditions specified, but the machinery for carrying the Act into successful operation is not provided. But even, so far as it goes, its effect is, I believe, beneficial, and an extension of the system on the lines introduced in some States of America, afterwards referred to, would increase its usefulness. The other parts of the correctional system are whipping for juvenile offenders (male) under 16, fines and admonition. There is great difference of opinion as to the value of whipping. One experienced writer says,—"It can scarcely be necessary to say that, in any effectual treatment, flogging can have no part."

The latest, and one of the most intelligent American writers on the subject says,—"Whipping is recommended for cases of assault on women, for wife-beaters, and for similar offences. The danger of abuse, however, has been thought to be so great that this suggestion has not often been incorporated in penal law."

The elements of the correctional system are, therefore, deprivation of liberty, physical pain, and pecuniary loss. It is acknowledged by experts that the first part, as at present administered, is far from attaining satisfactory results; the other two parts have little appreciable influence on criminality.

The limitations on the efficacy of the correctional system, or the penal system, direct attention to measures for preventing the beginnings or the repetition of criminal acts. Among these measures may be mentioned the police forces, registration and identification of criminals, and industrial and reformatory schools. The police force is a modern creation, and its chief functions are preventive and preservative. In every police instruction book it is distinctly stated that the primary objects of a police force are the prevention of crime and the preservation of the public peace. It is doubtful if the original platform is maintained, and the preventive side of police duty appreciated as it ought to be. The detective branch has more and more, through the press and books of fiction, been raised to supreme importance, and in every force it will be found that more merit is attached to catching a thief that preventing a theft. One writer says :—" Clearly, when preservation of peace and prevention of crime are most effectual, detective services are least required. If any public sentiment of contumely or resentment still pursues the police, it must be derived partly from the various disagreeable circumstances of search, enquiry, capture, and punishment, which are the repulsive incidents of baffled prevention, less alluring in practice than in the pages of romance. The dignity of the peacemaker is the superior grace of the policeman and unstinted public esteem should reward a perfect preventive service." Another says that " individual members of the police force should be rewarded and honoured quite as much for warning and preventing as for arresting and convicting."

No doubt the improved organisation and distribution of the police forces have secured immunity from many crimes previously perpetrated, but they must share in whatever discredit is attached to the number of crimes still committed. It was shown in the evidence before the Committee on Habitual Offenders that police administration has a great deal to do with the numbers of persons apprehended. One experienced police-witness said that "the more efficient the management of a police force is, and the more the police keeps in touch with the public, the fewer will be the apprehensions." The Committee were so much impressed with this and other similar opinions that they recommended that the Inspector of Constabulary should, as part of his duty, enquire into local peculiarities of police administration, and where they seem to him to call for notice, should report on them to the Secretary for Scotland. It cannot, in my opinion, be too strongly impressed on the police that the prevention of the development of the criminal is much more important than the prevention of his depredations after he has been allowed to develop.

A complete system of registration and identification of criminals gives the authorities better control over them. Until recently, this important branch of police and prison work was based on a rough and ready method which was wholly unreliable. Photography did not, as was expected, solve the question, but now there is in existence, for those who wish to avail themselves of it, a system at once speedy and effective. The Bertillon system of identification has been in operation in Paris for many years with the greatest success. It has been partially adopted in this country, and the results have been extremely satisfactory.

Reformatory and Industrial Schools are the agencies for dealing with youthful delinquents; the former are for juveniles under 16 years of age, convicted of an offence punishable with penal servitude or imprisonment, the latter for vagrant and neglected children under 14 who may not actually have committed an offence, but who, if left in their surroundings, are likely to join the delinquent population. In other words, Reformatories are for actual, Industrial Schools for potential delinquents. The Reformatory Schools are under private management, subject to the inspection of a Government Inspector; the Industrial Schools, which are also inspected, may be either privately managed or be managed and financed by School Boards or Town or County Councils. The Government allows a capitation grant to both classes of schools. The result of the training in these schools has been very satisfactory. A Royal Commission which enquired into their working, etc., reported as follows :—

"Before these schools came into existence, it is beyond doubt that a large portion of adult criminals of the worst class consisted of those who either in childhood had been neglected, or trained to a career of crime. From the cessation of this source of supply a gradual diminution in the number of criminals convicted of the graver or indictable offences might naturally be expected; and this result, due doubtless in part to other co-operating causes, but largely to the agency of these schools, has been obtained with signal speed and to a remarkable extent."

The Home Secretary, in a speech in November, 1901, said, in the three years prior to 1897, 13,390 boys left these schools. Of these 10,862 were known to be in regular employment; only 970 of them had again been convicted.

To sum up, the only bright spots in the present system of treatment of criminals seem to be the agencies for dealing with the young—the means adopted for preventing additions to the volume of criminality at its fountainhead. The defence of society should, therefore, be developed in this direction, as it is evidently the only direction in which success has hitherto resulted.

I may just refer, for a moment, to the American system of State Reformatories for juvenile-adult criminals. The best known of these are Elmira (New York) and Concord (Massachusetts), and the idea at the root of the system is that juvenile adults (15 to 30 is the age at Elmira, and 15 to 35 at Concord) should be dealt with by other than the ordinary prison methods. It seems to be admitted that, up to a certain age, every criminal is, potentially, a good citizen; that his lapse is presumably due either to physical degeneracy or bad social environment; that it is the duty of the State to try at least and effect a cure, and not to class the offender off-hand and without experiment with the adult professional criminal. The cardinal features of the system are the "indeterminate sentence" and the power of paroling prisoners. The judge, in sentencing a prisoner to the reformatory, does not fix or limit the duration of the sentence, but the imprisonment cannot exceed the maximum term provided by law for the crime for which the prisoner was convicted and sentenced. In the reformatory the prisoner, or inmate, as he is called, undergoes physical exercises and mental and manual training, and when it is believed that he is fit to take his place in the outer world again, he is paroled by the Parole Board which consists in New York State of the Superintendent of State Prisons, the Warder, Chaplain, and Physician. If he violate the conditions of his parole, he is re-arrested and brought back to the reformatory. The managers of Elmira claim that the system has been very successful in reforming prisoners, and a Commission of Enquiry into the discipline of Elmira endorsed the statements of the managers regarding the success of the institution. Salillas of Spain says that all progress in penal jurisprudence lies in giving consideration to the man, and this seems to be the guiding principle in the American State Reformatories.

Another feature in American administration is the probation system. In the States of America and here, as I have already mentioned, there is a system by which the Court may sentence an offender to liability to imprisonment under certain conditions, if it appears that reformation may be brought about without imprisonment. In this country there is no provision for supervising the offender while on probation. In Massachusetts there is an effective provision for that purpose, Probation Officers, who have all the powers of police officers, being attached to the Court. Their duty is to enquire into the nature of every criminal case brought before the Court, and to recommend that any person convicted be placed on probation. It is claimed that it has been very successful in Massachusetts where a great many persons were saved from imprisonment, necessitating an expense to the country not only for the prisoner, but in many cases for the family which would have been thrown upon the city or town for support. A Public Commission which enquired into the system in 1896, reports that it worked with admirable results, and as a means of dealing with certain classes of offenders succeeded beyond question.

We move slowly in these matters, and it is to be feared that old countries, like old individuals do not relish the idea of following the advice or copying the examples of those much younger than themselves.

Somewhat the same principle of suspended sentences is to be applied in France, a law being about to be introduced into the French chamber to grant a judge the right of remitting the penalty even in serious criminal cases when it appears to him the best way of "moralising" the subject.

The opinion seems to be gradually gaining ground in all countries that our present system of dealing with criminals is not giving the best results and that changes will have to be made in the direction of substituting preventive and reformative for purely punitive and repressive methods. A careful calculator has estimated the crime bill of the United Kingdom at ten million pounds per year and it is always increasing. It is surely the duty of all citizens, therefore, to ascertain how the money is being spent, and if they are getting advantages commensurate with the expenditure. We may not hope to eliminate the criminal ; but we should, at least, try to discover means to limit his activities. Some assert that there is a mechanical regularity of crime. Quetelet declared that the budget of crime is an annual taxation paid with more preciseness than any other, and Ferri enunciates the law of criminal saturation. The latter states that just as in a given volume of water at a given temperature, we find a solution of a fixed quantity of any chemical substance, not an atom more or less, so in a given social environment, in certain defined physical conditions of the individual, we find the commission of a fixed number of crimes. If such be the case, then it is the duty of every State to so modify social conditions that they will not conduce to the commission of crime, and so to treat criminals that their development will be arrested and their anti-social tendencies checked.

The treatment of juvenile criminals—perhaps the most important phase of the criminal problem—is of great interest, and one or two suggestions relative thereto may be of some value. As already mentioned the power to utilise reformatory schools ceases at 16 years of age; after that age the prison is the sole resource of civilisation. The following extract from the English Prison Commissioners' Report for 1898-99 voices official opinion of the statutory provision of stopping at 16. "Out of 1,238 between the ages of 16 and 21 in prison on a given day this year, no less than 788 were for crimes of acquisitiveness, *i.e.*, larceny, burglary, house-breaking, felony. More than half had been previously convicted. No less than 280 had good and respectable homes. *Yet in spite of this we cannot regard the criminal character at this age to be fully formed.* 90 of these lads had no education, 512 very little, 496 fair, and 111 good. 211 had one or both parents dead, 183 had bad homes, 198 had no homes at all, and 30 lived in common lodging-houses. This is tough material to deal with, but there can be no doubt that it is out of this material that the professional criminal, who in later years fills our convict prisons, is evolved."

To show the necessity of dealing with criminals under 21, let me again refer to the Home Secretary's speech, in which he says, that in July, 1901, there were in English convict prisons 2,879 male convicts, 1,277 of whom were first convicted while under 21 years of age, and that nearly one-half of the whole of convicted prisoners were between 16 and 21 years of age. As regards serious crime, the same facts are observable in Scotland. In 1900 of 261 male habitual criminals discharged from Scottish prisons, 153 were under 21 when first convicted, and of that number 73 were under 16. Well might M. Albanel of Paris, in his paper to the International Society for the Advancement of Science and Art in Glasgow, in August, 1901, say, "The problem of youthful criminality is one of the most acute and pressing of our modern civilisation."

I start with the assertion that every community (police area might be the better term), should be responsible for the honesty and good conduct of every person within its jurisdiction, and that means should be taken to prevent any one becoming a criminal. To accomplish that end at present there are police, criminal courts, reformatory and industrial schools, prisons and philanthropic agencies; the police is under Town or County Councils subject to Government Inspection, the inferior criminal courts are under local control, the higher under national, the reformatory schools are under private management subject to Government Inspection, the industrial schools may be under private management or local control subject to Government inspection, and the prisons are under national control subject to local visitation. When a young person is sent to a reformatory or industrial school he is generally out of touch with the district from which he was sent, and the feeling of parental responsibility which each community should feel for each of its citizens is severed to a certain degree. I suggest that each town and county, or groups if necessary, should have reformatory schools for the education, literary, moral and physical, of their own delinquents. I regard as a fatal defect in our system the handing over by a city of one of its citizens to a private institution in order that he may be developed into a good citizen. If the city has responsibility at all, it has full responsibility. The Commission appointed to enquire into the reformatory system of Ontario recommended the compulsory establishment of such schools in every city and large town for the control and instruction of disorderly and neglected children. The age for admission should be extended to at least 18, and after discharge there should be such a network of supervision, effective, but not irksome, as would prevent lapse. Great care would have to be exercised in committing children to see that parental responsibility was not too easily surrendered; the first consideration would, at the same time, always be the safety of the child.

I am very much in favour of a separate court for disposing of children. Such a court exists in South Australia and Victoria, and was also recommended for Ontario by the Commission above mentioned. It prevents children making the acquaintance of the surroundings of an ordinary criminal court, for it is specially true of such that familiarity breeds contempt. The judge in such a court would be a man not only learned in the law, but full of tact and sympathy and intimately acquainted with child nature. It often strikes me that much of the failure in dealing with juvenile delinquents is attributable to the fact that our laws are made and administered by men of middle and old age from their own age stand-point. They fail to project themselves back to their own youthful days in framing and administering laws. They forget that a young person is an immature being; that he is going through a developmental process, both physically and mentally, and that the canons of conduct applicable to an adult are scarcely applicable to him. In civil matters 21 is the age of majority, but criminal responsibility emerges at seven years. Many of the acts committed are, from the child's point of view, quite normal and natural. The duty of the judge would be to carefully enquire into the life history of the accused—parentage, health, education, temptations—and to consider, not what punishment should be awarded for the offence, but what treatment would remove the possibility of the child's joining the army of criminals.

Attached to the Children's Court there would be officers after the nature of the Probation Officers in Massachusetts. Their duty would be to enquire into the cases and prepare the information for the judge. If the child was returned to the parents, they would still exercise supervision in co-operation with the School Board or the employer, if the child was over school age. If the home life and surroundings were likely to be inimical to the child's welfare, the Municipal School would be available. These are the suggestions I have to make regarding juveniles—the Municipal or County Reformatory School, the Children's Court and the Court Officer. These, together with the assistance and co-operation of police forces, school boards, employers and citizens generally, would, I am convinced, in a short time have a very material effect in lessening juvenile crime.

I do not submit these opinions without having some practical experience to substantiate them. Since giving some thought to juvenile criminals, I have been much struck with the inefficacy of our system, more especially that part which takes little or no account whatever of the child as distinguished from the offence.

In every case which passes through my hands, the investigating officer has, for some time past, furnished me with a report not of the crime alone, but of the life history of the child or young person, age and health, parents alive or dead, and their character, size of family, number dead, occupation and wages of father, size and rent of house, school attending and nature of attendance, Standard in school and companions. This report, together with the nature of the offence, is sufficient generally to indicate to the magistrate the best course to be adopted, whether to send to a Reformatory or Industrial School, or allow the boy home with his parents. If he is allowed home the supervision does not cease, for an officer looks in, just in a friendly way, to see how he is behaving. The sympathy of schoolmasters is also enlisted, and in every case they have been most willing to co-operate. In one year the number of juvenile criminals brought before the court fell from 58 to 10. I do not say the result is wholly due to the practice, but I do say there is some hope of saving the children by letting them feel that the magistrates, the police, and the teachers are their friends, and that they wish to assist, rather than obstruct them in the battle of life.

VI.—*Thermal Emissivity.* By J. W. PECK, M A.

[Read before the Society, 5th March, 1902.]

THE object of the present paper is to give an account of a new method by which the emission of heat at a surface may be determined. The subject is one which deserves investigation, for there is a considerable conflict between the results of different experimenters on the point. Empirical formulæ have been given by Newton,[1] Dulong and Petit,[2] Rosetti,[3] Violle,[4] Stefan[5], Weber,[6] MacFarlane,[7] Lodge,[8] Lees,[9] and Lorenz.[10] All these investigators have given expressions which were intended to exhibit the variational history of the thermal radiation from a surface. In them account is taken of the temperature of the surface, its condition of polish, etc.; of the nature, pressure and temperature of the gaseous medium into which radiation takes place; of the constitution, temperature and configuration of the material enclosure. In the later and more theoretical investigations of the radiation at high temperatures the wave length of the radiation is taken into account.

Most of these laws, however, are empirical. This is not in itself a defect, but as it makes direct experiment the only basis of the law, the comparison of results becomes a difficult matter, and contradiction between the results of different observers using different apparatus under different circumstances is rendered probable. As a matter of fact we have in the laws referred to above a considerable conflict of opinion. Thus the Newtonian law of simple proportion, though true for small temperature differences was soon found to be invalid when anything above about 5° C. of an excess of temperature was considered. It is nevertheless the law still quoted in the text books, and is also employed by Fourier in many of his famous solutions. The law of Dulong and Petit, based on a very elaborate set of experiments was confirmed by La Provostaye and Desains[1] and was regarded as an effective substitute for the earlier expression of Newton. It was, however, questioned by Soret,[2] Draper,[3] Ericsson,[4] and others. Narr[5] not only denies the validity of the Dulong and Petit law but goes further and says that his experiments lead him to return to the Newtonian law. Stefan[6] on the other hand puts forward his well known formula of the fourth power, and illustrates its validity from the results of Dulong and Petit. Later on Dr Bottomley[7] of Glasgow University denies the validity of the Stefan law for high temperatures, and Schleiermacher[8] in Germany working with similar apparatus arrives at the same conclusion. On the other hand Boltzmann[9] brings forward a theoretical verification of Stefan's law based upon electromagnetic and thermodynamic considerations. Lodge in a paper written in 1879[10] prefers to return to the Dulong and Petit law of 1818, but suggests two alternative expressions of his own. Lees[11] employs an expression introducing the n^{th} power of the temperature difference, and finds for n a value ranging from 1·16 to 1·26, while MacFarlane[12] uses an ordinary quadratic expression. I need not go into this matter further at the moment (as a comparison of all these expressions is being made the subject of another paper) but it is interesting to note the variety of formulæ which have been suggested, and the conflict of opinion that exists.

---

[1] Opuscula II., p. 420 (Edited by Castillionius 1744).

[2] Ann. Chim. Phys. 7, p. 225, 1818.

[3] Real. Acc. dei. Lincei (3) 2, p. 64, 1878.

[4] Comptes Rendus, 88, p. 171, 1879.

[5] Wien, Bericht, 79 (2), p. 391, 1879.

[6] Berlin, Akad, p. 565, 1888. Wied. Ann. 10., p. 103, 1880.

[7] Proc. Roy. Soc. 20, p. 90, 1872.

[8] Phil. Mag. (5), 7, p. 198; 8, p. 510, 1879.

[9] Phil. Mag. (5), 28, p. 429, 1889.

[10] Wied. Ann. 13, p. 582, 1881.

This divergence of opinion becomes less remarkable when we consider the number of variables that enter into the problem.

---

[1] Ann. Chim. Phys., 16, p. 337, 1846; 32, p. 338, 1848.

[2] Arch. Sc. Phys. (2), 44, p. 226 ; 45, p. 222, 1872.

[3] Scientific Memoirs, p. 44, 1847.

[4] Nature 6, p. 106, 1872.

[5] Pogg. Ann. (5) 22, p. 123, 1871.

[6] Sitz. Akad. Wien, 79 (2), p. 391, 1879.

[7] Phil. Trans., 687, p. 429, 1887. Proc. Roy. Soc., 42, p. 357, 1887.

[8] Wied. Ann., 34, p. 630, 1888 ; 36, p. 349, 1889.

[9] Wied. Ann., 22, p. 291, 1884.

[10] Loc. cit.

[11] Loc. cit.

[12] Loc. cit.

Let us denote the object of investigation—the radiation flux at a point of the surface—by F. F is then the number of calories emitted at that point per square centimetre per second, or the limit of the expression $\Delta H/\Delta S\Delta t$, where ΔH, ΔS, Δt are elementary amounts of heat, area and time respectively. F then is the dependent variable of the problem, and the result aimed at in the empirical formulæ referred to above is to express F as a function of certain independent variables. These independent variables are—if we use the phrase in its most general physical sense—as follows :—

(1) The physical nature of the radiating surface.
(2) The geometrical nature of the radiating surface.
(3) The actual temperature of the radiating surface.
(4) Its temperature excess above the surroundings.
(5) The physical nature of the gaseous medium (if any) into which radiation takes place.
(6) The temperature (actual and relative) of this medium.
(7) The pressure of this medium.
(8) The physical nature of the enclosure (if any).
(9) The geometrical nature.
(10) The temperature (actual and relative) of this enclosure.

We can conceive of variation of F being produced by variation of any of these quantities or physical conditions. Their number, and the fact that such conditions as are involved in (1), (2), (8), (9) were widely different in the experiments alluded to above, will go far to explain the conflict of result. For example Dr Bottomley finds his results in disagreement with the Stefan law of the fourth power. But the latter results were based upon the radiation from a glass thermometer bulb, whereas the former are derived from the behaviour of a glowing platinum wire.

It is to be noted that most of the expressions have aimed at the temperature difference as the important variable; and that so far as this variable is concerned there is a general agreement with one another and with the Newtonian law for *small* temperature differences. But this is, of course, what one would expect for the same reason that the elementary part of any curve whatever may be considered as a straight line.

Another point worthy of notice is that very few of the experimenters, especially the earlier ones, give their results in absolute measure, so that comparison is rendered difficult. Even among those who do state C.G.S. results, *e.g.*, MacFarlane, Bottomley, Lees, the dissimilarity of the conditions prevents a complete comparison. MacFarlane's results refer only to a copper ball, and the temperature range is from 5° to 60°. Bottomley employs a platinum wire, deals with temperatures up to 800°, and makes the pressure of his medium range from that of the atmosphere up to very high vacua. Lees uses cylindrical bars of different metals, but not at high temperatures nor at varied pressures.

In the method here to be described I have not as yet attempted any variation of the temperature or pressure, but merely give for a definite and not very great temperature difference of radiating face and enclosure, a C.G.S. value for the quantity F referred to above. The pressure of the medium, and the nature of the enclosure are quite definite, and, as the conditions of the radiation are more akin to those that hold in actual practical problems, it is hoped that the result may be of some interest from the engineering point of view.

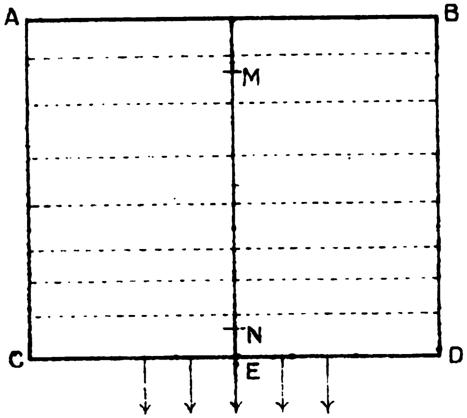
The theory of the method is briefly as follows:—In a previous paper[1] I have pointed out that the ratio of k to e (where k denotes the conductivity of a substance, and e the emissivity of its surface, both expressed in C.G.S. measure), has the dimensions of a length. This is a length characteristic of the thermal properties of the substance, and has evidently nothing to do with the dimensions of any particular piece of the material. Denote this length by L. If then L can be measured directly in any way, and k is already known, we can at once derive e. It is to be noted that we suppose e to be defined merely as the value of the radiation flux F divided by the temperature difference, and no assumption is made as to the constancy of e, or as to the law of its variation with the temperature difference. The question to be answered then is, under what conditions will L coincide with any of the actual dimensions of a block of the substance, or in what way can it be directly realised and measured. If we take the well-known equations for steady conduction and emission with plane isothermal surfaces, viz.:—

$$Q = k\frac{v_1 - v_2}{d}At \qquad ; \qquad Q' = e(v_3 - v_4)A't'$$

where Q denotes heat quantity, v temperature, d length perpendicular to the isothermals, A area measured on an isothermal, t the time, and k and e as before. Arrange that Q shall be equal to Q', v_1-v_2 to v_3-v_4; A to A'; t to t'. Then d will be equal to k/e, that is to say the distance between the two points in the body whose temperature difference satisfies the above conditions is the required length L. To realise this in practice we should

---

[1] British Association Report, 1901.



therefore have a slab of the substance AD radiating perpendicularly at E, and having in the block plane isothermals parallel to CD. Then if two points, M, N can be found such that their temperature difference is equal to that between the face E and the medium into which the radiation takes place, then all the conditions are satisfied, and MN is the required length.

The practical difficulty however arises that for iron say this characteristic length is about 500 cms. Since the block must have also considerable dimensions transverse to the flow of heat, an enormous mass of iron would be needed if the method were to be directly applied. On the other hand, a slab of some badly conducting substance, such as marble, for which the value of L is only about 17 cms., might be chosen, and direct results obtained by balancing the external temperature difference against the internal, through a thermo-electric circuit.

In the present experiment an iron bar was employed, and the difficulty of the length was got over in this way. A short bar was taken, having sufficient transverse dimensions to ensure linearity of flow at all points within a centimetre radius from the axis. The temperatures were measured at axial points by means of thermo-electric junctions, and so the temperature gradient was got. Hence can be got by simple proportion the hypothetical length necessary to give the temperature difference involved in the definition of L. Thus since L is found experimentally, and k is known for the substance, the value of the emissivity can be found. From another point of view, this amounts to employing the Fourier equation

$$k\frac{dv}{dx}=e(v-v_0)$$

which holds at a radiating surface. We measure $\frac{dv}{dx}$ which for the case of the steady temperatures and plane isothermals may be taken as the temperature difference between any two points on the axis of the bar divided by the distance between them. We also measure v, v_0, and so have data to determine e. Results will not, however, be stated in terms of e, for, as has been remarked above, no law of the variation of the radiation flux with temperature has been generally accepted, and unless some such law is assumed, e is itself just as much a variable as F. Results will be given in terms of the radiation flux (number of calories emitted per sq. cm. per sec.), corresponding to a definite temperature of the radiating face.

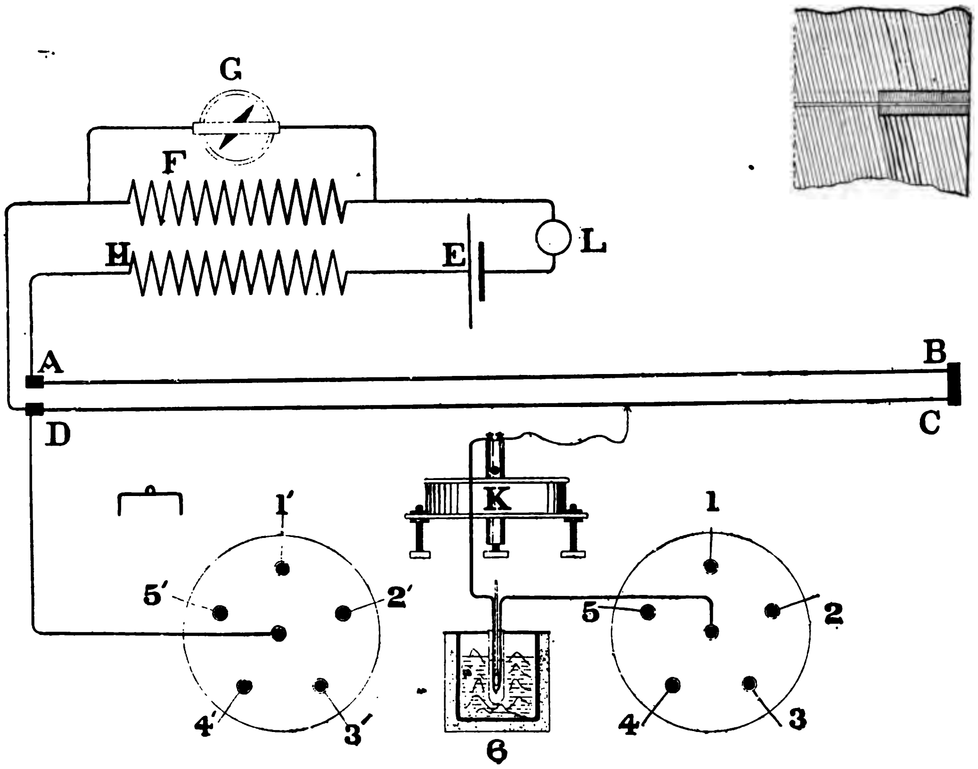
The experimental arrangements will now be described. In the final form of the apparatus the arrangement shown was employed. The iron bar is cylindrical in shape, is 53 cms. long, and 13 cms. in diameter. Out of the top is turned a cylindrical cup 10 cms. deep to serve for heating. There thus remains a length of 43 cms. for the thermal measurement. The proper choice of this length, and its ratio to the diameter, is a most important point. If the ratio of length to diameter be not less than a certain critical value, the isothermals will not be planes in the central region of the bar. In other words, the bar is so long that the radiation at the curved surface is producing effect even at the central filament of the bar. This must not be allowed to take place, or else the theoretical conditions are not fulfilled. On the other hand, if the bar be too short, the temperature drop will be so small that the unavoidable errors of the temperature readings will produce a considerable percentage error in the result. A certain intermediate length must therefore be chosen, so as to avoid these sources of error on either side. The length of the bar was therefore chosen so as to give a temperature drop of about twelve degrees under the circumstances in which the measurements would be taken, and then the diameter was chosen so as to be on the safe side of the limits prescribed by Berget in his experiments on conductivity. In his experiments it was essential to have linear flow and plane isothermals, and he investigated the value of the ratio of length to diameter, for which the radiation at the curved surface would be non-effective. In his method for measuring conductivity—known as the guard ring method—he is only concerned with the temperatures of the axial filament, and provided the flow in that filament is linear, the temperatures of the exterior shell of the material is only important in so far as it provides an efficient shield to the inner part. The same holds here. Effective thermal insulation is gained by using a large cylinder of the material, but the essential feature is the temperature distribution down the axis. The linearity of the flow was also confirmed by observations of temperature at the four points shown, which are spaced at equal distances apart down the axis.

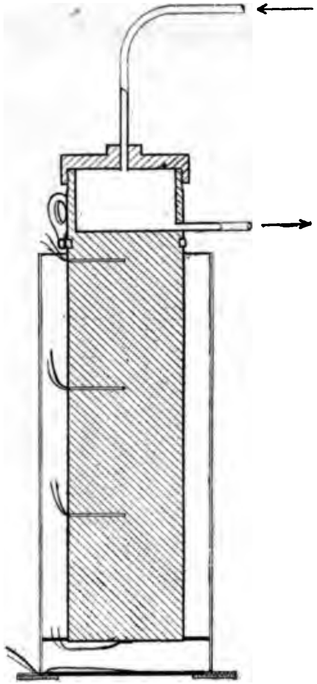
The whole bar is supported by ropes passing through the rings, and is carried from a heavy wooden frame work. On the top is screwed a cover, and through it passes a branched inlet pipe for the steam, and an exhaust pipe as shown. The steam which in the final arrangement is taken from the heating system of the building passes in at the top, is sprayed against the face and then exhausts at the side. It was arranged at certain periods of the day to have careful firing at the furnaces, and a steady pressure maintained at the boilers, and so the face was kept at a temperature of considerable constancy. The cylinder is wrapped round with a thick coating of felt, and round this again there is a glass cylinder, which extends down 2·7 cms. below the bottom. This cylinder thus forms part of the radiation chamber, and also prevents air currents getting at the bar. Cardboard collars are placed as shown, and opposite the bottom of the bar at a distance 2·5 cms. was placed an iron plate 3 mms. thick, and 17·8 cms. in diameter. This was held in checks on the wooden framework, and so a radiation chamber, definite in form and structure, was provided.

The method of measuring temperature is next to be described. Holes had to be sunk to the axis to admit the thermo-electric junctions, but Messrs Barclay, Curle & Co., shipbuilders, who kindly supplied the bar, found it impossible to drill holes sufficiently narrow and long enough to reach the axis of the bar. A method of bushing was therefore resorted to, as shown in the diagram. A hole, 1 cm. ($\frac{3}{8}''$) diameter is first turned out, but only to half the distance to the axis. A small hole, slightly less than $\frac{1}{8}''$ diameter, is then drilled out to the axis, and the bush, already drilled with a similar hole, is then driven home. Thus the continuity of the material is not interfered with to any serious extent in the outer jacket, and hardly at all in the central part. Holes were made in this way at the three points, and into them the thermo-electric junctions of iron and German silver were inserted, with a little mercury to ensure good thermal contact. A fourth similar junction was soldered on to the radiating face, and this face, as well as that of the opposite plate, is carefully coated with lamp black.

For the measurement of the temperatures of these axial points the following electric arrangement was adopted. The iron and German silver wires (both insulated throughout their length) were brought from the bar to a common switchboard shown in the diagram. Numbering the junctions from the top of the bar downwards we have five in all—four in the bar and one soldered on to the upper face of the plate. In addition there is a sixth junction placed in a tube of oil, which is immersed in melting ice, and which serves as the standard lower temperature for any of the other five. The one group of holes has the German silver ends, the other the iron. The board is a block of paraffin, and the holes are filled with mercury. The central cup of one group contains a wire leading off to one of the tapping points of the potentiometer presently to be described; the central cup of the other leads through the standard junction 6 and then through the mirror galvanometer K to the potentiometer. A wire connecting piece having one end always kept in the first central cup can be rotated so as to have its other end in any one of the cups 1, 2, 3, 4, 5. Another similar connector is used to join the other central cup the corresponding cup of the group 1′, 2′, 3′, 4′, 5′. Thus any one of the junctions in the bar or that at the bottom plate can be thrown on to the potentiometer through the standard junction in the melting ice, by merely putting the connectors to the corresponding points on the switchboard.

To balance the thermo-electric E. M. F. generated between any of the bar junctions and the standard the following potentiometer arrangement was adopted. It will be noticed that by using such a method as this in which no current runs in the wires when the


G
F
H
E
L
A
B
D
C
K
1′
5′
2′
4′
3′
6
1
5
2
4
3



final reading is being taken all question of the resistances of the wires and the various connections is got rid off.

A B, C D are the two sections of the potentiometer wire (each a metre long) on which the readings are taken. They are carefully chosen uniform wires of platinoid having a joint resistance of 1·4 ohms. The points B and C are connected by a thick brass strip, and the slider has four contact makers so as to allow of connection being made at any point of either wire. E is a storage cell of capacity about 21 ampere-hours so that, as the current running was only about 1/550 ampere, a constant potential drop is maintained in the wire throughout the whole course of the experiments. This constancy was of course checked by having in the main circuit a sensitive tangent galvanometer G (resistance 249,8 ohms, 1785 turns, constant ·0007 ampere for 45 degrees deflection). This galvanometer was shunted by a resistance F of 140 ohms while in the main circuit a rheostat H kept at 1000 ohms was placed. The potential drop in the wire A B was therefore about ·003 volt, and by the subsequent calibration it was found that 2 cms. of the bridge wire gave a potential difference equal to that produced in a German silver and iron couple by a temperature difference of 1 degree C. The wires AB, CD therefore correspond to the stem of a thermometer reading from 0 degree to 100 degrees C. It may be noted at this point that after the balance position is found, a motion of the slider of 2 mm. is sufficient to produce a perceptible movement in the mirror galvanometer. The arrangement is therefore sensitive to at least the tenth part of a Centigrade degree. The mirror galvanometer K used to indicate the balance in the circuit of the junctions was a Kelvin moving coil galvanometer (No. 547, resistance 14·99 ohms, 81 turns, constant ·000,000,047 ampere per scale division.)

Iron and German silver were used for the junctions because a couple composed of these two metals has a high thermo-electric power, and also because their lines on the thermo-electric diagram are practically parallel straight lines, and consequently the E. M. F. generated is proportional to the temperature difference. Each of the junctions was, however, calibrated carefully before using, and a table of values made out by means of the potentiometer arrangement described above so that corresponding to the slider position for any junction the temperature is known from the calibration tables. A subsequent re-calibration of one of the junctions proved that it had not altered through lying in the bar, etc.

The calibration was done as follows:—the junction to be calibrated was bound firmly on to the bulb of an accurate thermometer, and the thermometer was then placed in an oil bath which was heated to about 110 degrees and then allowed to cool. The junction was then connected by means of the switch board into series with the ice cold junction and the mirror galvanometer, the whole chain being put on to the potentiometer. The main key L of the potentiometer being closed, and the slider being put at the point 200 cms., one observer noted the spot of light, while another observed the thermometer. As the thermometer fell the spot of light which had been deflected drifted towards the zero, and as it passed through the position of no current, the one observer made a signal, and the other noted the thermometer indication. The slider was then shifted to 190 cms., and the observation was repeated. Thus the calibration was carried right down the scale, in some cases the readings being taken every 5 instead of every 10 cms. From the table of values thus got, any intermediate points could be derived by interpolation.

In the actual experimenting the steam was usually circulating for about four hours before any readings were taken. The steady temperatures were by this time established, and the readings for all the junctions could then be taken by means of the switchboard within a period of five minutes. Series of readings extending over two hours were thus taken, and from the columns of figures the most steady sets could be selected. It is impossible to get absolute steadiness in experiments of this kind, owing to variations of the steam supply, draughts of air striking the radiation chamber, etc. But by using a large bar (the total heat of the bar used in these experiments was 385,000 calories reckoned from 0 degrees C) and choosing it of a good conductor so that the temperature variations are rapidly transmitted throughout it, the effects of these uncontrollable fluctuations may be largely reduced. The annexed table shows the magnitude of such fluctuations; for some of the various experimental arrangements tried.

Date.	Time of the Series.	Average Temp. diff. of points read.	Maximum variation from mean during interval.
Nov. 8,	43 min.	22·2°	·2°
„ 13,	48 „	22·5	·3
„ 14,	20 „	22.0	·2
„ 21,	20 „	14·1	·4
Dec. 18,	28 „	12·6	·2
„ 20,	20 „	12·2	·3
Jan. 10,	58′ „	6·7	·3
„ 14,	65 „	6·5	·2

From the results of many series of observations, the following may be taken as the value of the radiation flux in C.G.S. units, ·035 for a temperature difference between radiating face and enclosure 50·5° C. The observations on which this result is based are the means of several consecutive series taken on different days, lasting over the periods of from half an hour to one hour, and showing a maximum variation in that interval of ·3° from the mean. This represents an accuracy of about 4 per cent. Results from series on different days do not differ from each other by more than this percentage.

The special feature of this method is that it is a steady temperature method, and so all question of the magnitude of the specific heat of the substance and its variation with temperature is avoided. In most of the previous methods, on the other hand, the temperature varies, as it is the rate of cooling that is employed to give the result. A second point is that the only measurements actually taken are those of temperature and length, both capable of considerable accuracy. The difficult measurement of heat quantity which usually appears in a steady temperature thermal measurement, *e.g*, Berget's method for conductivity is avoided. A value of the thermal conductivity is of course used for calculating the result, and it might be said that since this is employed, the more difficult thermal measurement is implicitly present. But it is one thing to employ the same value of *k* throughout, and another to have to determine at each set of readings the number of calories passed through the bar, as has to be done in the Berget method. In any case, the measure of conductivity has been carried to a far higher degree of accuracy than that of emissivity.

The value of k that I have used is derived from the most recent results given by Hall in the "Physical Review" for 1900. He gives the value ·154, and states a temperature co-efficient, which gives a percentage variation of less than ·8 per cent. in the range of temperature that I have employed. Berget also states that the temperature variation for such a range is negligible in the degree of accuracy attained in thermal experiments.

Another point to be noticed is that in these experiments the emission of heat has been taken in an enclosed, but not air-tight chamber, full of air at ordinary pressure. This then gives the external conductivity (*conducibilité extérieure*) of Fourier, and it is to be noted that three distinct effects are involved, viz. (1) the true radiation from the surface, *i.e.*, the effect which would still remain if the process went on in vacuo. (2) The convection effect of the gaseous currents. (3) The true conduction effect of the gas, *i e.*, what it would transmit in excess of the radiation, even if the convection currents were entirely stopped.

Dulong and Petit, in their empirical formula use two different expressions, one for the first of these effects, another to represent the second and third together. Stefan's law applies only to the true radiation effect, while in the investigations of MacFarlane and Lees the whole three are grouped together.

A comparison of results with previous results in C.G.S. measure leads to this that the value of the flux is considerably greater than that given by MacFarlane, but is in agreement with that given by Lees. For a temperature range of 30 to 80 degrees the emissivity, according to the former, increases only by 16 per cent., while according to the latter the increase is 50 per cent. The MacFarlane law is given by the expression[1]

$$\cdot 000238 + \cdot 00000306t - \cdot 000000026t^2$$

for the emissivity, while Lees employs the expression et^n for the flux of heat, where n has a value ranging from 1·16 to 1·26, t being the temperature excess in both cases.

Taking the value of the emissivity for a one degree temperature difference at 16 degrees as ·00024 for a black surface (for small temperature difference there is no wide divergence of opinion), and taking the value of the flux and temperature difference found experimentally above, we find that to satisfy the law of the power stated by Lees, *n* must have the value 1·27. This is in fair agreement with his results, and is at any rate much closer to it than that of MacFarlane.

---

[1] Kelvin, Mathematical and Physical Papers, Vol. III., p. 244, where t^3 is erroneously given in place of t^2. *Vide*, Proc. Roy. Soc. 20, p. 90, 1872.

One possible source of error (but not a large one), in these results is as follows:—In a preliminary experiment the bushes in the bar penetrated right down to the axis, and as there were only two of them, there was no means of testing the linearity of the flow. In the subsequent experiments one end of the bar was cut off, and the form of bush mentioned earlier in the paper was employed. One, however, of the original ones remained, and caused a slight deviation from the equality of drop of temperature down the bar. The error due to this cause cannot however exceed four per cent.

This, in some classes of experiments, would not be a high degree of accuracy, but in experiments on radiation into a gaseous medium, where so much depends on the stream lines of the heated gas, there is inevitably an arbitrary and uncontrollable element. Between results of different observers much greater percentage differences exist so that the degree of accuracy I have mentioned may be considered satisfactory; but of course in several ways which only suggest themselves after working for some time, the measurements might be refined. Study of the effect of varying the temperature difference of the radiation faces and the pressure of the medium are the natural developments which are to be proceeded with so as to give a more complete view of the subject. It has been thought, however, that the present, as a first set of measurements by the method, might be of interest to the Society.

VII.—*Rents and Ground Rents. Facts and Figures bearing upon the "Housing Problem."* By WILLIAM FRASER, F.S.I., Surveyor and Valuator.

[Read before the Economic Science Section, 12th March, 1902.]

THE Housing problem in its entirety, as at present before the public, and calling for the attention of the authorities, has many other issues besides financial details.

Points of administration and sociological considerations will bulk largely in the attempts at solution, but in matters connected with housing, the question of "What rent is to pay?" occupies the foremost position in the minds of many people and will always be the main concern of the tenants.

That feature of the problem is common to many other difficulties which perplex people of limited means. It is the everyday and somewhat commonplace problem of how to obtain the utmost value possible for every shilling expended.

It appeals to the artizan whom we characterise expressively as "well to do," but it reaches an acute stage in the case of the labourer and the casual worker, whose weekly budget rarely shows a surplus after providing the bare necessaries of life.

With a sympathetic desire to learn the best means of procuring the cheapest house accommodation for the poorer classes, a little time may be profitably devoted to the consideration of actual rents at present paid for workmen's houses, and to a discussion regarding the bearing of these rents upon the financial aspect of the problem.

All that I can contribute to the common stock of information is a few very elementary facts as to the rents, the costs of building, and the prices of ground.

These really form the A B C of the subject, but of course they should be mastered before one can prescribe fanciful fiscal reforms or propound political remedies.

Perhaps the easiest way of obtaining some useful material for discussion will be to take one or two examples of rents paid for small dwelling-houses, and analyse these carefully.

When a chemist is confronted with the problem of dealing with a puzzling and refractory substance, his first step is to determine its composition by means of solvents, crucible, balance, and lens.

Treating rents in an analogous fashion, we should begin by splitting up the sum received by the landlord from his tenant into its various elements.

These elements represent the several destinations or purposes to which the money is applied.

The elements are well known, and indeed are self apparent, but it will be useful to set them down in order. They are :—

1. Interest on price of land.
2. Interest on cost of buildings.
3. Sinking fund or provision against the depreciation of buildings.
4. Sum to meet landlord's taxes.
5. Annual outlay for repairs and upkeep.
6. Insurance, collection, management, and incidental expenses.

And in addition, an element too often lost sight of,

7. An allowance for empties and lost rents.

For the purpose of exemplification, I propose to limit our enquiry meantime to three types of workmen's houses.

Instances could be multiplied, but those I shall quote, which are founded on actual experience, and which are neither exaggerated nor exceptional, will, I think, prove amply sufficient as a basis for discussion.

For those who wish additional details, I might refer in passing to the very valuable papers on the "Housing of the Labouring Classes," and on "Back Lands" written by our esteemed Chief Sanitary Inspector. They contain a mass of analytical detail wrought out with painstaking care.

In order that you may intelligently appreciate the subjects of our analysis, I would ask you to accompany me on an imaginary visit of inspection to the three different houses.

I have selected houses of the room-and-kitchen or two apartment class. This class, according to the recent census, contains almost half the population of Glasgow.

I wish you first of all to familiarise yourselves with the type which we shall characterise as the modern artizan's house.

It is situated in a good central locality, convenient for the tenants' work, and it forms one of twelve houses in a four storey tenement, built within the past six or seven years.

While we are critically looking at the structure from the outside, we cannot help noticing with satisfaction that the clean windows and tidy white curtains bear evidence of a desirable class of tenants. We enter the property through a closs, the walls of which are lined with tiles; we observe that the back court is asphalted, and that there is a wash-house in the corner in full operation. Half way upstairs there is a water closet which serves for the three tenants on the first landing.

Entering one of the houses, we find that it comprises a parlour to the front and a kitchen to the back. In each apartment there is a recess containing a bed, and a press in the wall. The house appears to be finished in a substantial fashion, neatly painted and papered, and is fitted by the builder with blinds and grates.

The house is nicely furnished as befits a well-to-do artizan earning perhaps from 35s. to 40s. per week, and the tenant's wife has nothing but praise for the house and for the factor, who is most attentive in the matter of repairs. Her only objection to the house is the dear rent, and the consequent heavy burden of taxes.

The rent, we learn, is £11 a year; we can only sympathise with her, and we go off to make investigation into the factor's statement to ascertain where all the money goes to.

The rent of £11 is paid quarterly, but it will be convenient for comparison if we reduce it to its weekly equivalent and that is 4s. 3d.

It is worth while noting that this weekly rent works out 1s. 3d. per 1,000 cubic feet, the capacity of the house being 3,350 cubic feet.

It may seem incredible, but it is nevertheless true that, if capacity be deemed the measure of value, this house is actually cheaper than many of the Corporation and other model-dwellings, the weekly rents of which in some instances reach fully 1s. 6d. per 1,000 cubic feet.

We shall endeavour to sift this later on, but meantime we proceed to work out the analysis.

As regards the *value of the ground*, in the instance quoted, we may take it that the price is 25s. per square yard, calculated upon what is termed the net area, that is the area occupied by the tenement itself, and the back-court attached thereto. The net area of ground in this case would be 280 square yards, and the cost of 280 square yards at 25s. is £350. If we adopt the common practice of calculating the price upon the area of ground measured into the centre of a street 50 feet wide, £350 would represent a rate of 18s. 5d. per yard upon a gross quantity of land extending to 380 square yards.

I have chosen these prices because they represent probably the highest rates which builders would pay for ground for the erection of dwelling-houses.

Generally speaking, when ground commands a higher rate than 25s. net, or 18s. 5d. gross, it is on account of its suitability for business premises, and house rents cannot compete with these.

Charging interest on the price of £350 at 3½ per cent., we are faced with a ground rent on the whole tenement of £12, and this represents 12s. of an annual ground burden upon each apartment, there being 20 apartments in the block.

Reducing the 12s. to a weekly sum, we have 2¾d. per week for each room, or 5½d. per week for the ground rent of a modern room-and-kitchen house in a fairly central locality.

I have been somewhat minute in going through the details of this calculation, but I trust that I have made the result perfectly clear, as it is of no small importance, and is a point upon which many people have very erratic ideas.[1]

We turn next to the element of *cost of building*. We are fortunate in being able in such a tenement as is under consideration to gauge this to a nicety.

Without troubling you meantime with very particular details, you may take it that the cost of producing our room-and-kitchen house is as near as may be £145, which of course covers for its contribution to the expense of outside washing-house, street paving, etc.

Such a cost is equivalent to about 10¾d. per cubic foot calculated on the available capacity of the house, or about 5⅜d. per foot on the whole cubic contents of the tenement measuring in the walls, floors, roof space, stair, etc.

---

[1] It is perhaps as well to point out that sometimes we find ground annuals forming a heavier burden than above indicated. These, however, do not represent the real price or value of the land, but are financial expedients adopted by builders and others, forming actually a first charge or bond on the property. As the effect is to enable the builder to borrow a larger sum at a low rate of interest, the system tends of course in the direction of cheapening rents.

I mention these figures, because most people are familiar with the comparison of building costs on cubic contents, and they will serve as a convenient standard for discussion afterwards. It is interesting to note in passing that in the kind of tenement we are now dealing with, approximately half the cubic contents of the building is absorbed in walls, floors, roof, stair, etc., the half only being free cubic space for living in.

Coming back, however, to our cost of £145, if we charge interest thereon at 5 per cent, we have a yearly sum of £7 5s., representing about 2s. 9d. per week to pay a return on the cost of erection.

The landlords annual outgoings for *taxes*, *repairs*, and *management* are easily ascertained from the factor's statement, and the reduction of these to a weekly proportion for this particular house is a simple matter of arithmetical calculation.

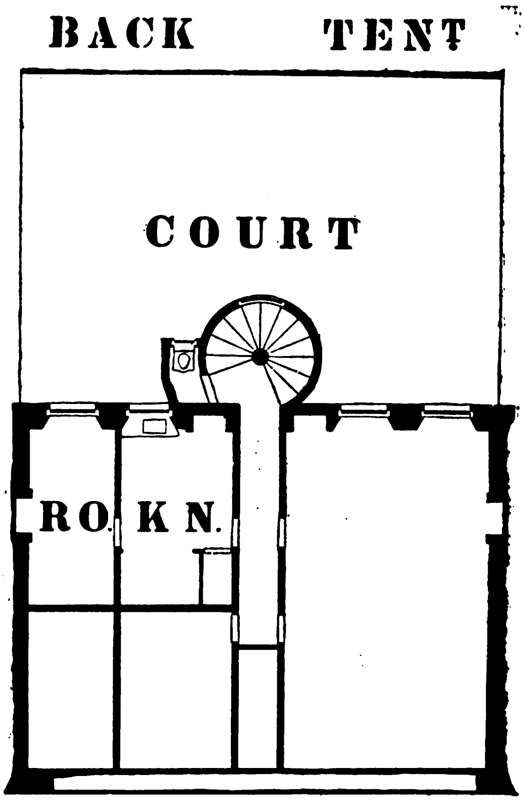
We are now in a position to make up our tenant's little bill for the week. It stands thus :—

Ground rent at 3½ per cent. on price of 25s. per sq. yd.,	5½d.
Interest on cost of building at 5 per cent,	2s. 9d.
Landlord's taxes,	5d.
Commission for collection, insurances, and other expenses of management,	2½d
Repairs and upkeep,	5d.
Total per week,	4s. 3d.

Without pausing to discuss the results we have obtained, I would ask you now to take a hurried visit with me to a "ticketed" room-and-kitchen. It is a slum, but not by any means the worst of its kind. The situation is also central, and the building is ancient—anything from 90 to 100 years—but its antiquity does not command veneration.

The appearance from the outside is dingy; there are, no doubt, some clean windows with tidy muslin screens, but they are the exceptions. On the other hand, one or two broken panes patched with paper or perhaps rags lend variety to an elevation which has certainly no other architectural feature.

The closs is a narrow one, and leads to a circular stair (or "turnpike" as it is called) at the back of the building. There is no such luxury as tiling here, and instead, the walls of closs and stair present an unwholesome appearance of crumbling plaster and cement. A shaft of water-closets has been built alongside the staircase within recent years to comply with the requirements of the authorities. On arriving at the first landing, we are confronted by a long dark passage with four doors entering off it. We tap at the first door we come to, observing the metal plate or ticket affixed, with the legend "1,750 cubic feet, 4 adults."



If it is Monday, there will be some hesitation on the part of the good lady in opening, in case we are calling for the rent, but upon our entering and betraying an interest in the arrangement and state of repair of the house, our hostess at once becomes friendly and jumps to the conclusion that we are "the Sanitary," and a powerful weapon in her hands against the common enemy, the factor.

The latter gentlemen is, it may be, the same individual, who received so flattering a testimonial from the last tenant we visited, but circumstances alter cases.

We do not remain any longer than we can help, partly because the house, being back to back with another one, has no through ventilation, and it is a considerable time since a washing has taken place either as regards its floors, or its napery, or yet its inhabitants. The effect upon our sense of smell is none of the pleasantest, and at the same time our ears are assailed by a continuous catalogue of complaints from the goodwife whose vocabulary as well as her voice gains strength as she proceeds.

We notice that the house looks out entirely to the back, and faces a "back land" of similarly dreary aspect. The apartments are small; the kitchen enters directly off the landing, and the room enters off the kitchen without the intervention of a lobby. As regards repair, the house is far from satisfactory, but one cannot help noticing, that, to some extent at least, the condition of the house is a reflection of the character of the inhabitants. The broken panels of the doors, and the numerous dents in the plaster of the walls all point to drunken violence, rather than to ordinary tear and wear, while the dirty state of the kitchen-sink quite accounts for the frequent chokage and overflow of that useful appliance.

We leave the house puzzling over the social aspect of the case; we have first a sneaking sympathy with the husband, who,—in escaping from the dismal surroundings, the bad atmosphere, the dirt and his wife's energetic eloquence,—finds more congenial company in the corner public-house.

Then, with a chivalrous desire to do the wife justice, we would fain excuse her shrewish tongue, and her loss of the sense of cleanliness on account of her husband's unsteady habits, and we can scarcely wonder at her losing heart in such an environment. One feeling predominates with us and that is pity for the children.

We call upon the factor for further enlightenment, and we get some additional facts and information.

We learn, for example, that the property is in the hands of trustees, who hold it for behoof of a widow, whose life-rent from these houses is her sole income, and a meagre one at that. The factor's great problem is how to maintain the revenue and maintain the structure at the same time.

We have a look through his accounts for the property and find that in some years, practically half the rental is swallowed up in outgoings, in which heavy disbursements for repairs, and leakages from arrears and bad debts bulk largely.

I select one of the more favourable years for analysis of the rental of this ticketed house. The rent (excluding stair gas and water rates) is £6 8s. or fully 2s. 5d. per week, which for 1,750 cubic ft. is equal to 1s. 4½d. per 1000 cubic ft. The ticketed house is thus relatively 10 per cent. dearer than the better class artizan's house already dealt with.

We find that in the particular year I refer to, the property has earned 5 per cent. on the price last paid for ground and buildings.

There is no ground rent, and the land and the structure are merged into one so far as the present holding is concerned. If we assess the land at what neighbouring plots have been realising for commercial purposes, there is practically nothing left for the structure, and any other allocation between ground and buildings would be simply a matter of opinion.

It is better however to leave the separation to those who deem themselves authorities on the subject, so omitting this opinionative detail, and confining ourselves to facts, we find the analysis of the weekly rent to be :—

Interest on price of ground and buildings at 5 per cent.,	1s. 4d.
Landlord's taxes, - - - - - - - -	3d.
Lost rents, - - - - - - - - -	3d.
Repairs, - - - - - - - - -	5d.
Management, insurance, etc., - - - - -	2d.
	2s. 5d.

I am sure you will agree with me that it is pleasant to turn from such sordid surroundings, and as a contrast consider for a few minutes the analysis of the rental of one of the model-houses built by the Glasgow Workmen's Dwellings Company.

Probably you are all aware that as one excellent result and proof of the value of the commission appointed by the Glasgow Presbytery some 12 or 14 years ago, to enquire into the housing of the poor, the Workmen's Dwellings Company came into existence.

Under the management and direction of some of our shrewdest business men, cheap healthful homes have been provided by the Company for nearly 3,000 of that class of people for whom neither the ordinary builder nor the ordinary investor cared to cater.

3,000 may not seem a large proportion of the 78,000, who, Mr Fyfe tells us, inhabit the ticketed houses of our city. But I firmly believe that the Company's operations has become that "little leaven" which will eventually leaven the whole tough intractable "lump" of sodden slum-land.

Already I find in my own experience that private owners and factors are following the Company's lead in many details and improvements to the advantage of their tenants in the matter of comfort, of themselves in the matter of pounds shillings and pence, and of the community at large in the matter of public health.[1]

For our present purpose, I select a two-apartment house in the block known as Cathedral Court, built by the Company about 10 years ago in Rottenrow.

There is no need to take up your time with a description of the character of the house and its occupants. I would advise everyone interested in the subject to study the little booklet issued by the Company, modestly entitled "Some experiments in Housing," and for which I believe our president, Mr Mann, is largely responsible. That fact in itself is sufficient to commend what, I think, is the latest, and is certainly one of the most important additions to the literature of reference upon the housing question. I am glad to be able to borrow facts from such a source.

The only points of description I wish to emphasise are the airiness of the houses which are "through-and-through" and enter directly off a balcony, the fact that the block is five storeys high, and lastly, that it is built of brick, roughcast on the outer walls.

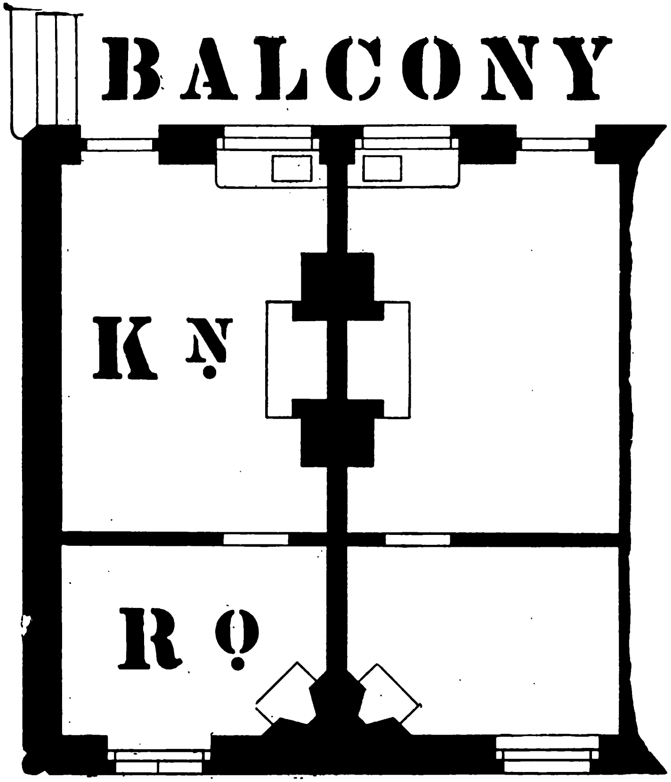
Still confining ourselves to essentials, we must first take a firm grasp of a few financial details.

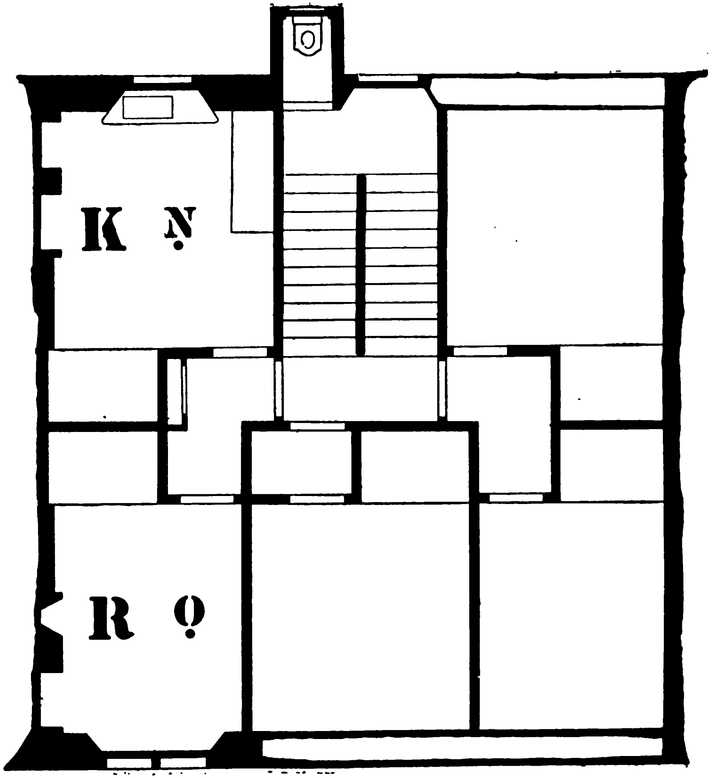
First.—The ground forming the site cost 20s. per sq. yard.

Second.—The cost of providing the two-apartment house, as nearly as can be approximated in somewhat complicated circumstances is £105. That cost calculated upon the net capacity of

---

[1] Not only in Glasgow is there an earnest endeavour, in a quiet and unostentatious fashion to "do something" to further the better housing of the poorer classes. In other centres experiments are in progress, a notable one being in the neighbouring Burgh of Pollokshaws, where Sir John Stirling-Maxwell, Bart., M.P., has erected a model block, which, it is hoped will be extended shortly. From the particulars, kindly furnished me by his factor, Mr J. Campbell Murray, F.S.I., I find the experiment has been so far successful, but as the results practically confirm those of the Glasgow Workmen's Dwellings Company it is unnecessary to repeat the details.


BALCONY
K Ṇ
R Ọ


K Ṇ
R Ọ

1,800 cubic ft. is 1s. 2d. per ft. as against 10¾d. in the modern artizans dwelling first mentioned.

Third.—The revenue from the property after allowing for landlord's taxes, a caretaker, management, and a sum for repairs and depreciation, has yielded a return of 3½ per cent. on the cost of the land and the buildings.

Fourth.—The annual amount appearing in the accounts for repairs and depreciation (equal to 12½ per cent. of the gross rental) is not actual outlay, but most wisely includes a sum placed to reserve to meet future upkeep and depreciation. If only actual repairs are deducted, the net return on the cost would come up to 4 per cent.

The average rent of the two-apartment houses in Cathedral Court is £6 11s. or 2s. 6¼d. per week, equal to 1s. 4¾d. per 1,000 cubic ft., as against 1s. 3d. in the modern artizan's house, and practically the same as the 1s. 4½d. which we found in the ticketed house.

We can now state the analysis of our weekly rent of 2s. 6¼d. It works out as follows :—

Interest on price of ground costing 20s. per sq. yd. at 3½ per cent. - - - - - - -	2¾d.
Do. on cost of buildings at 3½ per cent. - -	1s. 4¼d.
Landlord's taxes, - - - - - - - -	3d.
Repairs and depreciation (being 12½ per cent. of total rental), - - - - - - - - -	3¾d.
Caretaker, - - - - - - - - -	1½d.
Management, insurance, and sundry expenses. -	3d.
	2s. 6¼d.

Having thus arrived at some concrete results based upon facts, what do we learn from them ?

Let us first consider the question of *interest* or return upon the capital invested. In the two cases first quoted, we have seen that the private owner is earning 5 per cent. on the money he has sunk in the building. I may remark in parenthesis that this is probably rather better than what our present experience points to in the matter of property investments, the interest being usually nearer 4½ than 5 per cent.

Some people are apt to think that 4½ or 5 per cent. looks rosy on the light of other investments.

It is certainly true that 1½ per cent of an advantage is being obtained over other heritable investments, such as bonds and ground rents, but we have to bear in mind the risk in property-holding, of accident or damage to the structure, the certainty of eventual structural deterioration of the building by tear and wear, the possibility of depreciation in value through the houses becoming-out-of-date, and what is frequently forgotten in these days of prosperity, namely, the chances of part of the property remaining empty, should we have a period of trade depression.

Twenty years ago, my earliest professional experiences were gained in the "dark days" of property, when it was no uncommon thing to find that three out of twelve houses in a tenement were unlet.

A repetition of this state of matters would take a large slice off a 4½ to 5 per cent. return.

I think therefore that private owners are not likely to be tempted with any property investment unless it shows a margin of 1½ per cent. above the rates obtained from the more secure ground rents and bonds in order to provide for these risks and depreciation.

A Corporation, such as our Municipality is, I consider, on the same footing as a body of trustees, and ought, on no account, to indulge in building speculations either for profit or investment.

Force of circumstances, however, may compel a corporation to build, and in such an event, I am strongly of opinion that if there is not to be a loss, the rents of the premises supplied should be calculated to yield a margin beyond the bare interest at which money is being borrowed.

Now this margin may be applied as a sinking fund, which, in the case of a corporation dealing with large sums of money, can bear ample fruit at compound interest.

For example, if money is being borrowed at say 3 per cent., it is worth while noting that an additional ¾ per cent. would at compound interest, provide for the redemption of the capital sunk in about 55 years.

But if the rent is to be fixed so low that it is incompatible with providing such a margin or sinking fund, let us frankly face up to the fact that the difference must sooner or later be made up out of the rates. And in such a case the tenants of the low-rented houses are really receiving, as it were, parochial or municipal relief at the cost of the ratepayers, either of this generation or of the next.

While thinking of the question of interest it may have occurred to some, that the Workmen's Dwellings Coy.'s dividends have been at the rate of 4 per cent., although the Cathedral Court property is yielding only 3½.

The leeway is made up by the better results from the reconstruction of old and disreputable buildings acquired by the company, and converted into sound sanitary dwellings. The return from these ranges from 4¼ to 5¼ per cent. so far as the results are complete.

Of course there are many old buildings which are quite incapable of such treatment, but it seems to me that the Improvement Trustees might go the length of considering at least whether they should not, in a few instances, retain the shells of the more substantial slum buildings they acquire, and follow the company's successful example in reconstruction, rather than in demolition. The latter course has made the ground too dear for re-building low-rented dwelling-houses, but the Workmen's Dwellings Coy. and others have shown in several cases, that it is possible to renovate and render sanitary some of the most hopeless looking subjects—worse than a number of the Improvement Trustees' purchases—and, when finished, obtain a satisfactory return by letting the houses at practically the old slum rents.

I should like, now, to say a little about the effect of *ground values* upon rents.

We have seen that the tenant, in the first example, who is sitting upon ground at 25s. per yard in a central situation to be near his work, pays a ground rent of 5½d. per week.

In the third example of the smaller model-house in Rottenrow, he pays 2¾d. per week, where the ground cost 20s.

If we take him out to land costing a fourth of this in the suburbs, we would be able to reduce this item of his rent to 1½d. per week for the larger house, or say ¾d. for the smaller one. Many landed proprietors would be more than delighted to accept rates such as permit of these lower figures per week. The Corporation has recently acquired more than 100 acres of land at Blochairn at much smaller prices.

If we take our tenant to agricultural land, the ground rent element practically disappears altogether.

We therefore see that the price of land in the suburbs and outskirts of a large city such as Glasgow will add the relatively unimportant sum of ¾d. or 1½d. per week to the workman's rent beyond what it would be if he lives in an agricultural district.

An additional 2d. to 4d. a week (depending upon the size of his house) meets the extra cost of ground in, say, Port-Dundas, Rottenrow, Bridgeton, or similar localities.

Against this last figure, it would possibly cost, in car fares, at least 2d. per day, or 1s. per week to bring a man from his suburban residence to a central place of employment, and if one or two of his family also travelled, the cost would be doubled or trebled.

These are facts, and require no comment save that they indicate a first step in the direction of useful enquiry as to the situation of available land, particularly in relation to the more important industrial localities, and the probable cost of acquiring that land.

The results before us show that the workman is actually cheaper sitting on ground at a substantial price to be near his work, than he would be to trust to our splendid car service; and in addition he has the great and economical benefit of being able to get home for his meals.

But the *cost of building* produces the bulkiest item in our rents—sometimes more than a half—and presents the greatest number of difficulties in providing cheap houses.

Time will permit of only a few of the features of this part of the subject being dealt with, and that somewhat scrappily.

We are all aware that an increase in cost of building has taken place within the past 15 or 20 years, but I don't know that the extent of it is realised by everyone, and I can assure you I am putting it moderately at *20 per cent.*

Workmen's wages largely account for it, but it is not the increase of wages alone, but the decrease in the quantity of work per day or per hour now produced by the workman.

For example, I have been told by an old and very experienced builder that, 40 years ago, an average day's work for a mason, when hewing stone, was reckoned at 10 sq. ft., and his wages were 6d. or 6½d. per hour.

Now, with his wages running from 10d. to 11d. per hour, the mason may produce from 6 to 7 sq. ft. of hewing.

Even allowing a considerable latitude for exaggeration in the statement regarding "the good old days," there is, I think, every reason to believe that an extra 50 to 75 per cent. has been added to the labour bill in this department.

Every right-minded member of the community rejoices at the fact of the workman being able to earn increased wages, and no one wishes him to injure himself by overwork, but I doubt if anybody will maintain that it is a sign of physical or economic healthiness when the present-day workman cannot or will not, or perhaps is not allowed to produce as much work now as his father formerly could and did.

We have, however, to face the present prices of building, and in the light of these, we might profitably consider, for a few minutes, one or two practical and technical points, regarding which some people appear to have misconceptions.

First, as to the *height of buildings*, one is often told that dear ground is the cause. No doubt it is, to a considerable extent, in the case of central business premises; but in the case of dwelling-houses, it plays a very small part, particularly so, because, under the Glasgow Buildings Regulations Act,[1] if the height of the tenement be increased, the size of the ground has also to be increased, so that no advantage is gained, in this respect, by adding another storey.

But in the matter of cost of building, a more important saving takes place, and this will be apparent after a moment's consideration.

Whether we decide to build a three-storey tenement or a five-storey tenement, we shall have certain expenditure common to both. That is to say, we require, practically, the same roof, gable-tops, and chimney-heads, the same foundations and digging, as well as paving, drainage, and outside work, not to mention the same legal and professional charges.

I have calculated the amount of money represented by these items in a tenement of the type of our modern artisan's house, and find that there is £265 of common expenditure to spread over three, four, or five storeys, as the case may be. Not to trouble you with the details of the calculation, I may just give you the broad result, and that is, that a house in a five-storey block can be produced 10 or 11 per cent. cheaper than one in a three-storey block.

Of course, the advantages of the latter may be considered worth the difference; but if you are aiming at cheapness, there is the result.

---

[1] Under Sect. 40 of the Glasgow Buildings Regulation Act, 1902, it is provided that the open space in front of a window must be equal to at least three-fourths of the *height* of the wall in which such window is placed. This regulates the width of courts. Sect. 61 provides that the height of a building containing dwelling-houses shall not exceed the width of the street.

The next point I would like to put before you is one which you will have already observed. It is relatively cheaper to build a large apartment than a small one. The example quoted of 10¾d. per cubic ft. of cost, in the case of the artizan's tenement, against 1s. 2d. for the Cathedral Court property, affords a striking instance of this, the contrast requiring explanation all the more because the latter property is much more plainly constructed and finished than the former one.

The explanation is very simple. It is not the solid cubic capacity which costs money, but the walls, the floors and the ceilings forming the enclosures, and these are relatively much greater in a small than in a large apartment.

If we take a perfect cube, and double its linear dimensions, the area of its enclosing sides is quadrupled, but the cubic capacity is increased 8 times. That is to say, if a room measuring 10 ft. each way is increased in size to 20 ft. each way, the enclosures only increase from 600 sq. ft. to 2,400 sq. ft., while the capacity increases from 1,000 cubic ft. to 8,000 cubic ft., and while the cost increases from £100 to £400 we get 8 times the accommodation, or in other words the *cost per cubic foot* of the large apartment is only half of that of the smaller one.

Another thing to bear in mind is that the same expenditure on plumber's fittings, doors, windows, fireplaces, etc., is common to the large and to the small house alike, and this also brings up the cubic cost of the latter.

I have to apologise for wearying you with these mathematical and technical details, but the cubic standard of cost and rental is so often misused in talking of the housing question, and the data for comparison so frequently misapplied, that a word or two of caution are, I think not out of place.

Cubing is a useful shorthand method of calculation, but its results, unless under proper application are not infallible. And the main fact with which we now concern ourselves is that we have a higher *rate* of cost per cubic foot, and consequently a higher *rate* of rental, the smaller we make our apartments.

As a final point on this question of cost, I think it might be interesting to you, if I give the result of a calculation I have made regarding the saving which might be effected on the cost of the modern artisan's house, supposing the building be erected in the plainest possible fashion, and denuded of all ornament and superfluous expenditure.

For example, we may build the front wall of plain rubble work instead of the more ornate polished stone commonly used; we may also dispense with cornices in the parlour adopting plain plaster work throughout, and use much plainer joiner work instead of the bound and panelled doors, etc., with which we are familiar.

By pinching at every point, we could probably save nearly £20 on the cost of the house, which would represent a weekly reduction on rent (including the reduced landlord's taxes) of somewhere about 5d. That is to say the better class workman really pays 5d. per week for the luxury of ornament and superior appearance of his house, but no doubt if he were offered his choice, being a man of taste, he, or at any rate his wife, would prefer the more expensive article.

The item of *taxes* may almost be passed without remark, but the figure I have included in the three statements requires a little explanation.

It represents practically only the local taxes, as property and income-tax is a deduction common to all investments, and the net income from heritage is, of course, entitled to bear its share of this charge.

I find, however, that as a matter of everyday experience, income from rents bears a larger share of Imperial taxation than other forms of revenue, inasmuch as the deductions from gross rental allowed under schedule A for local taxes and repairs are insufficient for these, and the owner of a property really pays a portion of his income-tax upon income which he does not enjoy.

This shortage at the present high rate of the tax represents an additional penny in the pound, and brings up the landlord's taxes, which I have included to fully 1s. 11d. per £.

I wonder how many of our Glasgow ratepayers actually realise, as they grumble at their local taxes as tenants mounting up to about 4s. per £, that they are as a matter of fact further contributing in the shape of rent additional taxes of 1s. 11d. per £. The money, although it passes into the landlord's hands, does not reach his pocket, but is absorbed for the ever increasing wants of our municipal and other local authorities.

It is interesting to notice in passing that this very respectable total of about 5s. 11d. per £ shows an increase of about 40 per cent. on the local rates of 20 years ago. At present the tenant of an £11 room-and-kitchen house really pays 1s. 3d. per week for the municipal and parochial benefits which he and his family enjoy.

It is unnecessary to deal in detail with the other outgoings which the landlord has to meet, and which go to make up the rent.

But it is worth observing that while the artizan in his £11 house is charged 7½d. per week in respect of upkeep, management and sundries, his poorer brother in the slum requires to pay 10d. Part of this, it is true, is necessary to cover for the bad debts and losses due to his poverty or improvidence, or it may be, he is paying for the misfortunes or faults of his neighbours.

His repair bill too is heavy; that is in some measure accounted for by the fact that the building is an old one, but it has to be confessed that a great deal of carelessness and avoidable waste contribute largely to the item of repairs.

Turning to the accounts for the Cathedral Court property, we find that the repairs (which as already stated, are inflated by an allowance for depreciation) amount to 3¾d., and management represents another 3d. Lost rents do not appear in the bill, but we have instead another charge for a caretaker.

The influence of this new factor in our account however, tends not only to the disappearance of bad debts and to the minimising of repairs, but also to the permanent preservation of the property, and the wellbeing and comfort of the tenants. His services are well worth the extra 1½d. per week, which is saved on the other items.

It is of course impracticable for owners of small properties to employ a caretaker for his whole time, but a free house or a substantial reduction in his rent, would be a sufficient remuneration to induce a handy and tactful man to fulfil to some extent a caretaker's duties in a property of limited size.

Some factors and landlords adopt the system, and it is gradually extending. The difficulty is to find the right kind of man.

Having so far dealt with facts, might I venture in conclusion an opinion or two as to the cheapest possible rent for living room, which I think compatible with sound finance?

I shall not trouble you with the details, but ask you to assume the price of ground at 10s. per yard, and charge interest thereon at 3½ per cent.

The buildings would be five storeys high, of the plainest possible description, but the interior would be plastered and even decorated with paint, size colour and whitewash; the interest on the cost to be 4 per cent.

On the plan of the modern artizan's house, I think by curtailing the size of the parlour somewhat, we might compress the 4s. 3d. rent to 3s. per week on the lines stated.

On the balcony plan I do not think it possible to reduce the Workmen's Dwellings Coy.'s rent below 2s. 6d. or thereby. Any economy or saving in cost would be counterbalanced by the increase of interest from 3½ to 4 per cent.

On a corridor plan, if approved by the authorities (that is with houses entering off both sides of a corridor, open at each end for ventilation) I think a large single apartment of say 1,600 cubic ft. could be provided for a little over 2s. per week, say 2s. 3d. and a small apartment of the minimum size of 1,000 cubic ft. at about 1s. 6d. to 1s. 8d.[1] These sums are all exclusive of tenant's taxes.

It must be clearly understood that the above rents, with their 4 per cent. return, and with undesirable tenants, are insufficient to tempt the ordinary property investor. Further they presuppose the houses to be kept well let and the rents paid regularly, a condition entailing some difficulty with unselected tenants.

The estimates, I think, are corroborated in the experience gained by the Workmen's Dwellings Coy., but their tenants are selected, and the bad debts virtually nominal.

By dispensing with plaster work and other finishings you could, no doubt provide the tenant with a shelter of bare brick walls at a saving of a few pence per week, but if his or her poverty requires such restrictions, I think it is time to give parochial or charitable help towards supplying human beings with accommodation somewhat superior at least to what is provided for animals.

Then as regards the dissolute and the vicious, there is such an infinitely fine grading in the character of even the undesirables, that it would be difficult in segregating tenants to determine ex-

---

[1] ESTIMATE OF WEEKLY RENT.

	S.	D.
Building cost of 1,000 cub. ft. at 1s. net, equal to £50 at 4 per cent, say,	0	9
Ground Rent, - - - - - - - allow	0	2
	0	11
Taxes, - - - - - - - - -	0	1½
Repairs, - - - - - - - - -	0	2
Management, - - - - - - - -	0	1½
Caretaker, - - - - - - - - -	0	1½
Total,	1	5½

But to allow a margin say 1s. 6d. to 1s. 8d. per week actly the degree of wickedness necessary to qualify for residence in bare brick walls. And, assuming such to be satisfactorily fixed, would it be altogether of benefit to have a man's character stamped according to the house he lives in?

This and other allied questions of selection and administration however, are rather outwith the scope of the subject I have been asked to deal with, and the few facts which I have gathered together will, I trust, be of some service to you in your deliberations on the "housing problem"

VIII.—*Discussion on "Housing Problems."* A contribution from the Economic Science Section. Opened by Professor William Smart, M.A., LL.D, at the Meeting of the Society, 19th March, 1902.

In introducing the discussion, Professor Smart said—

There are many who say: "Why not let things alone? There is no more a housing problem than there is a butter and eggs problem. The supply of houses will adjust itself to the demand for them, just as the supply of butter and eggs does."

The difficulty arises because there are certain things we can not let alone. Vice is one; dirt and disease are another.

If we were to let these things alone, no doubt, in time, things would come right—in a way. In the 14th century, before the Black Death, the Goverment and the towns let things alone. Down came the plague. When England had lost half her labour and only the strongest survived, wages rose. As result, came the emancipation of the serfs. There is, then, something to be said for leaving dirt and disease alone.

But we do not let them alone, and, in sequence of this, we do not let housing alone. We put restrictions on the sale of articles dangerous to health, and an overcrowded insanitary house is a very dangerous article—as dangerous as tuberculous milk. We say, in short, that no property owner shall sell to any individual less than 400 cubic ft. of air space, plus certain requirements of sanitation. And these things cost money. You can buy small eggs, "cooking eggs," bad butter if you like: you cannot buy a small room or a room without a window.

It is, in effect, a kind of sumptuary law. In old times, when governments were more outspoken and had, perhaps, more confidence in their own wisdom, they enacted that the people should not be allowed to wear certain things which they wished to wear, because, said the Government, extravagance is not good for the lower orders. In our case, the municipal government puts its enactment the other way about. "You are wanting cheap and bad houses," it says, "and we are determined that you won't get anything but good and dear ones."

Thus the Municipality has very seriously interfered with the freedom of supply, and it has as seriously interfered with the freedom of demand. It prevents people getting cheap houses for which they could pay, because it will not allow anything but dear houses to be built. And then comes the problem: If the people cannot pay for them, what is to done?

But, quite apart from this sumptuary law, there are other things which make houses dear, and this again brings out how different houses are from butter and eggs.

Most goods have gone down in price. But one class of house-room, in Glasgow as in most cities, has gone up. Taking the average of the prices of commodities of common use, ruling between 1866 and 1876, as 100, prices fell steadily to 61 in 1896. Then they rose to 75 in 1900, when they began to fall again. Now they are about 69. But, all this time, the rent of small houses in Glasgow has not fallen, and of late it has risen very considerably.

The first reason for this rise being the sumptuary law, the second is that, in the city, families who want small houses are increasing more rapidly than the houses to accommodate them. Houses must have ground to stand on. But other things besides houses require ground to stand on. Shops, warehouses, factories, railway-stations, public buildings, parks, streets, railway lines, all compete for the same space, and that space is a limited one. Only a certain number of houses *can* be built on it. Thus there is an increasing demand for a limited supply of houses, and supply, in this case, meets demand in the usual way—by a rise in price of the article demanded.

There is a perfect example of how this acts in London to-day, where, in certain districts, houses have fallen out of the competition altogether, and the area is covered by business premises.

There is a third reason. It is that building costs have gone up. Within 20 years, building materials have risen from 15 to 30 per cent. according to the kind of material. Building wages have risen, say, 25 per cent.

This, then, is the state of the case in Glasgow. It is the general case, I think, of all large growing cities. Rents have gone up owing to the working together of three causes:

the various sanitary requirements, the competition for limited space, and the price of building.

Is this the Housing Problem? I say it is not. A man cannot very well complain that he has to pay half-a-crown for a house with good light, good ventilation, good drains, good sanitary appliances, instead of two shillings for a house with no light, no air, no drains, and disgusting insanitary appliances. The immigrant from the country may be reminded that it may be cheaper to pay an extra sixpence for rent in town, rather than remain in the country and get four shillings less wage. A mason, at least, cannot very reasonably complain that he has to pay a higher rent if he is shown that it is his high wage that is the cause of it. The problem, I say, is not here, because, if rent has risen, wages have risen and risen doubly—the money wage has risen and the purchasing power of the money has risen. It is quite a mistake to think of rising rent in cities as in general a proof of increasing hardship, or of the greed of land and property owners. It is not the case that the rising flood of annual income, in virtue of which life gets easier for the nation as an aggregate, is checked within the city area, or unnaturally diverted. We require, I think, to be reminded of Ricardo's law in the analogous case of agricultural land: the east-coast farmer, for instance, who pays £4 10s. per acre of rent is not worse off than his west-coast neighbour who pays £2, but better off.

Unless I am much mistaken the general Housing Problem is this. In the congested area of high rents, there are many thousands of people whose wages have not risen; men and women whose wages cannot rise much—not that they are kept down by force or intention, but simply because the men and women in question are not worth more. They are not skilled workers; that is, owing to natural defects or defects of education and training, they have not found—are not able to find—that field of peculiarly human effort for which there is an increasing demand. Or they are people skilled in some manual occupation which has gone down before organised production, like the needlewomen before the sewing machine. They are, in fact, as a rule, the "marginal workers"—human factors whose "worth" is measured by their product, and whose product is only the same as can be turned out by the factor called machinery at a low cost.

This class has a special claim on us because their misfortunes are so greatly one of the consequences of our progress. They are the failures incidental to the factory system which has made us, on the whole, so rich. How are these people to be housed—the people whose wages have not risen and who cannot possibly pay the risen market rents? This I conceive to be the Housing Problem of all large cities, except, perhaps, London, where house rent seems to have risen faster and further than wages.

But, while this is the general housing problem, Glasgow has, besides, a problem peculiar to itself. Another sumptuary law—and, in calling it "sumptuary," I do not mean to disparage it; it is, in fact, one we all approve and demand—has made our general problem acute. Certain houses—back-to-back houses, pestilential houses, houses which should never have been allowed—have been declared unfit for human habitation and are to be shut up in July of this year. If the law comes into operation, on that date between 1,000 and 2,000 houses will be shut up and their tenants turned out.

The law will not come into force in July: we know very well it cannot. These houses are dangerous to public health, to public morals. The Sanitary Officer wrings his hands and prophesies woe and disaster. But the magistrates say, "There are no houses for these people to go to at rents which they can pay. It is a choice of two evils. Better some kind of house than none."

But will delay bring any remedy? No man can answer Yes. Some houses are being built, but they are dear houses—dearer, at any rate, than these people can pay, and, moreover, they are taken up, the moment they are built, by new comers.

Is there, again, any sign that, if the law delays, rents will come down? Well, there is just a gleam of hope here. Building costs are coming down. And building efficiency, one may hope, is going up. We have had strong statements made lately that, some time ago, London bricklayers were laying some 400 bricks a day, while the Westinghouse people now assure us that, under proper Trade Union management, bricklayers are laying over 2,000. If that is the trend of things, then building costs may come down, although wages do not come down.

But on the other hand is to be put this; that the competition for space is increasing. Glasgow has a long way to go before the price of its land comes up to the price of London land. But our population is increasing proportionally more than twice as fast as London. I see no prospect of a check. What will happen is, that the city will widen its borders and rents will rise in the suburbs. But they will rise still more rapidly in the centre.

So our Town Council, seeing no other way out of it, propose to borrow three quarters of a million and set to building at once—not, presumably, because they want to build, but in order that they may be able to turn the people out of the dangerous back-to-back houses and slums.

This, then, is their solution. It deserves not captious criticism but respectful examination. We see so little of our Councillors except at election times, and we know so little of their work except bare conclusions, brought up in the form of recommendations to the Council, that we forget, I think, that in committee our representatives sit for hours discussing and threshing out things round a table. We forget that they have information which we have not, and that they are guided by permanent officials. I have had a good deal to do with our Councillors during the last few weeks, and I can assure you that the members of the Improvements Committee at least are neither doctrinaires nor sentimentalists, but hard-headed men, with at least as much business ability as one will find among any board of directors of similar industrial enterprises. They are, indeed, it seems to me, very like the body of men to which I have the honour to belong—university professors—who are blamed for not doing this and not doing that, and can only answer that their time is so much taken up doing the duty which they are appointed to do that they have little time to do anything else.

But while, for this reason, I should treat their proposals as more likely to be right than the irresponsible criticisms of the man in the street, I must point out that the problem they are attacking is a limited one. It may solve a difficulty here and now, and yet be no solution of the whole housing problem. As a fact, they propose nothing more than to meet a present difficulty, viz., that of putting in force certain health provisions.

But even this special and limited problem has its own difficulties. Keeping clearly before us what the municipality proposes to do with the £750,000, the question is, Can they do it?

Remember what they must do in order to meet the necessities of the case. It is not a problem of building houses that will be filled and houses that can pay. They must be able to build and rent at a price within the means of those displaced. I think we may assume that this means a price under what private enterprise can afford to take. Here various questions are involved. Can they get cheap enough land? Can they reduce building costs? Can they—or rather will they—relax their building laws, their sumptuary laws? Failing all these, can they get their capital so much cheaper than private builders, that the difference will enable them to rent houses low enough? What, in other words, is the limit of the saving here? This should not be a difficult question, for there is another builder to compare themselves with. The Workmen's Dwelling Company charges certain rents for a four per cent. return. The Corporation must have three per cent. But the Workmen's Dwelling Company has stopped building because it cannot make four per cent. on new buildings; as a fact it never did make four per cent. on the older ones. Is the limit of advantage, then, of the Corporation over the Workmen's Dwelling Company, one per cent. only, and how far will this trifling difference allow the Corporation to go? Or is there some other saving in costs, which the Corporation has over the Workmen's Dwelling Company? But has even the Workmen's Dwelling Company catered for the very poor? Suppose we say it has built houses within the means of the 20s. a week class, how are the 16s. 10d. a week class to be housed—and unhappily there are hundreds of single women who do not earn anything like that? Besides, there are thousands of lodgers who cannot afford a house to themselves. The "lodgers" are a very large proportion, I imagine, of those who are to be turned out of the overcrowded houses. Where are they to go—for I understand lodging is not to be allowed in the Corporation houses?

Well, these questions are, so far, deductive. Personally, I quite admit the strength of the argument, advanced by many of my friends on the Council, that the way to find out whether the decent dispossessed poor can be rehoused or not, is to build and try. It is at least the easiest and the most certain way, although not the cheapest. But it is scarcely wise to shut one's eyes and say that these questions are of no importance. It may conceivably be found—although I hesitate to hint it—that this class of people cannot be housed except by coming on the rates. If so, the sooner we know it the better. Meanwhile, it will be observed that all the Corporation's arguments are based on the assumption that their houses will *not* come on the rates.

But there are two considerations which are on the side of the Municipality's solution, and I do not think they have got justice done them.

The first is that the class for which the Corporation proposes to build is much smaller than it seems to be. From all the evidence I can gather, there are at least hundreds among these thousands displaced who can afford to pay higher rent; who do not belong to the poor at all, but spend so much of their money in drink and other ways that they have not enough left to pay the market rent. Can the Corporation sift out this class? I think it can; by turning all the tenants on the street, and admitting into the new houses none but those who are bona fide small wage-earners. I know no way of forcing the others into better houses, paying more rent, but that of leaving them on the street if they don't. I say further that we are bound in honour to do this for the sake of the bona fide decent poor, for these high-waged improvident people are taking up house room to which they have no right, and, besides, raising rents on the decent poor.

And there is another class among the thousands to be turned out—the criminal and the vicious. I do not see that we *owe* them anything, but we cannot very well get rid of them. In the intervals between one term of jail and another, they are not criminals; they may even want to reform. But it is a misfortune, I think, if they are driven, or even allowed, to go into any houses they please. It is in their interest, as well as in our own, that I have suggested that there may be something between a jail and an independent dwelling, namely, a shelter.[1]

We are all, I think, agreed that these two classes should not be housed among the decent poor. But they form, I am afraid, the large proportion of those to be displaced in July, and, if these classes are deducted, it is not thousands of houses that will be required, but a very few hundreds.

The second consideration which strengthens the Municipality's solution is this; that, if we can house the decent dispossessed poor now, we close this part of the problem and have done with it. It is not a recurring problem; for it arises in rectification of mistakes which our ancestors have made, but which we are not, I hope, going to repeat. There will never again, I suppose, be back-to-back houses. There will never again be overcrowding. Suppose, then, the Corporation succeeds in housing this decent dispossessed class and stops there, we are done with that problem. We need not fear an influx of more of this class into the city, because, if they cannot get houses—and we are assuming that they cannot get houses from private owners at rents within their means—they will not come into the city.

---

[1] *The Housing Problem and the Municipality*, Glasgow, 1902.

I want to emphasise this, because the dread of many is that, to house this dispossessed class is only the beginning of housing an endless influx of similarly decent and similarly poor people. It seems to me one thing to build a certain number of good houses because we must pull down a certain number of bad ones, and quite another to build for anyone who likes to honour the city with his presence. It may, indeed, be the case that there are other slums than those now condemned, and that the Corporation will have to go further in the same direction before long. This, however, does not constitute a recurring problem; it is still a rectification of mistakes that will not be repeated; and, if I gauge the feelings of the citizens aright, they will not refuse anything that the Corporation asks to clear away centres of misery and infection.

But, it will be said, suppose the city cleared and beautified, the dispossessed housed, overcrowding forbidden, and no others able to come in unless those able to pay the rent which private enterprise demands, the problem is merely shifted to the outskirts and suburbs.

True, and I think this brings out the necessity of a larger municipal control than we have yet thought of asking for. There are houses just outside of Glasgow to-day which are going to be bad slums in a year or two, and probably, in a year or two, they will be within the boundaries of Glasgow. It deserves to be seriously considered if there is no way of getting some form of government control over the building and laying out of areas that will, sooner or later, be within the city, or, at least, so close as to affect it.

To sum up. I have tried to emphasise that there is both a general housing problem, and a special housing problem peculiar to our city. The special and limited problem of Glasgow is that, for the sake of public health and public morals, we have to rectify certain mistakes. The Corporation keeps its eye fixed on this; it has proposed a remedy for it; and no other remedy has been suggested. But, while this is the urgent problem, it is not the whole of the housing problem. And yet the whole problem is so inextricably bound together that the proposed remedy involves consideration of and dealings with all the other parts. Thus, while the remedy may cure one ailment, it will not cure the patient; it may possibly make him worse; at any rate it will not put him into a thoroughly sound state. Suppose then, this part of the problem solved, there remain the other two parts of the problem; first, and perhaps the more difficult, What are you going to do as regards the people who are neither poor nor decent, and, second, How are you going to provide for the rapid increase of population in such a way as to prevent the reappearance of slums and insanitary conditions?

If I stop at this point, it is because this is the opening of a debate and not a paper by me. I will only say that, where there is not one clear issue but a complication, the wise thing to do is, as the general practitioner does when the disease gets beyond his range—advise a consultation. Glasgow has a chance such as no city, I think, ever had—a Corporation anxious to face the problem, and citizens anxious only to be convinced that they are going to face the whole of it, and not shut their eyes to parts of it. If the Corporation will only initiate a really exhaustive enquiry, on the lines of a Royal Commission, it will earn the gratitude of every city in the kingdom.

DISCUSSION.

Mr Shaw-Maxwell said that, as a member of the Improvement Trust for a period of five years, and as one who had a very high opinion of its work, he desired to make the admission that their critics were perfectly right when they said that the Improvement Trust had barely touched the fringe of that great question. He did not blame the members, because they had difficulties which would be obvious to every intelligent reader of the newspapers, and they did the best they could. It was quite clear that, hampered as they were by the growing value of the important central sites with which they had to deal, and at the same time representing the people and therefore bound to work everything on a paying basis—not necessarily a profit paying basis—their difficulties were so great that one must be charitable in dealing with them. He understood that the question that night was whether or not the Corporation should leave the provision of cheap dwellings for the honest and industrious poor to private enterprise, or whether the Corporation should not confine its attentions to the provision of houses for those who were frankly recognised as belonging to the vicious classes. He feared that many were too apt to overestimate the number of the vicious in the community, and he suggested to Professor Smart that one of his first duties should be to get data of the numbers of the class in question.

The next point was this:—Supposing that the Corporation resolved to accept the remedy suggested by Professor Smart and built "barracks," what guarantee did Professor Smart offer that the reckless class which was so difficult to control would go voluntarily into these barracks? There were many of these people very excellent in the art of deception, and for the nonce it would be quite possible for them to assume a respectability, though they had it not—sufficient even to deceive a Corporation factor. He thought that Professor Smart would be very likely to discover that those people who had been under the direct control and care of His Majesty's officials, would want as little as possible of that when they were outside. It seemed to him that the majority of the tenants whom Professor Smart proposed for the Corporation would require to be brought up to sign the missive in the factor's office between two able-bodied policemen.

There was a further point—apart from the points of "How many are they?" and "Would they come?"—which he would commend for consideration, namely:—Was it desirable, even in a civilised city such as Glasgow, to segregate that mass of evil-disposed and ill-conducted persons? He thought it was quite possible they might err on the safe side if they declined to accept that, and agreed that, wherever there was a possibility of reform by rubbing shoulders with those who were still within the ranks of respectability, they should not decline to let them have an opportunity of reforming.

Mr Jas. R. Motion, Inspector, Glasgow Parish Council, said he would like to touch lightly upon the class of persons who occupied the houses referred to by Professor Smart. These houses were, generally speaking, occupied by the very lowest class of the community. The Poor Law Authority never had applications for outdoor relief from these districts. The applications, as a rule, were from the so-called labourer and his wife, and from single men and women who required medical treatment, and, after being in hospital, came out refreshed. In addition to these people there were the persons discharged daily from Duke Street and Barlinnie prisons between fifty and sixty men every day. Where were they to go, and where did they go? They occupied the farmed-out houses. In addition to the farmed-out houses, there were numerous tenements in the city that were also occupied by the very same class—whom Professor Smart would put into these shelters or barracks. Then they had the tramps who daily entered the city. During the last three weeks he had eighty-two applications from tramps—ranging in age from twenty to seventy-two—and all these were tramps who had been within the confines of the city for only some twenty-four or forty-eight hours. These, to a great measure, filled the houses before referred to. He might be taken as exaggerating things a little, but anyone who knew him or his work would pass that aside. So many statements had been made as to the people who occupied the houses in question, that, if it were for nothing else than to ascertain the condition under which these people were born—or wed—if they ever were wed—or died, an enquiry on these points would be an education, and would be necessary as a preliminary to any inquiry which the Corporation or any other authority might make. The poor people upon the outdoor relief roll were invariably well housed. There were a few cases to the contrary. For the past twenty-five years, for instance, he knew of a man and his wife who had been in a certain locality which was now a perfect hell. With regard to those who had come out of the poorhouses, they had in many cases gone to the public model lodging-houses, but he hesitated to go into details on the matter, as he might perhaps harrow the feelings of the ladies and gentlemen present.

Speaking before this Society in 1895-6, Lord Provost Chisholm has said that the erection of the model lodging-houses was forced on the Corporation by the observation of hundreds of men and women, living under horrible conditions in lodgings, who never desired to become householders, and who desired no care after the day's work was over. At that time, the Lord Provost had said that the closing up of the lodging houses on Corporation property would only drive the keepers into other property where less supervision would take place, and that, to enforce rules and regulations, would be far less effectual if it were not accompanied by an object lesson, showing how the thing could be done.

He (Mr Motion) wanted the Corporation to step further along this line and build houses for the accommodation of the classes thus referred to. He did not know the class of persons to whom Professor Smart referred, the decent, struggling poor, whose wages ranged from 16/ to 20/ per week; they did not come within his purview. It was a class below that with whom he came in contact: a few decent widows who were thrown out of employment from the causes mentioned by Professor Smart, and a great many others from the other causes which he had perhaps too largely dwelt upon. If the Corporation could be persuaded to appoint a Commission to get at the life of the people before referred to, and then promote measures to meet their necessities, it would be very desirable.

Professor Smart:—Do I understand you to say that in those one or two thousand houses that are to be shut up, there is scarcely any considerable proportion of respectable poor.

Mr Motion:—I do most undoubtedly.

Professor Smart:—Then there is no field in that direction for the Corporation to build?

Mr Motion:—I say no.

Mr John A. Todd said that was just the point he wanted explained. Was it not the case that these poor persons, who were not decent, were the cause of the admitted fact that the private builder could not deal with the housing problem? If they took away the bad tenants and left the decent honest poor, then the private builder could deal with the question. The great expense of repairs added to the difficulty of providing a shelter for the lower class of people.

Mr H. A. Mavor said that the possibility of there being bad landlords should not be lost sight of. He had had the misfortune, at the works which he occupied in the east end, to be neighbour to about ten slum houses. He was under the necessity of renting these houses—paying the rent for them to a former member of the Town Council—and boarding them up. That man let those houses to people at rents against which no respectable builder could compete. There was no water supply, and no sanitary appliances. The worse the tenant, the higher the rent. The landlord came down, wearing riding-boots, at eleven o'clock on a Saturday night, when the people were drunk, to get what money they had left. He did not know whether that was an exception or not, but these were facts. He believed that the problem of housing vicious people was at present in the hands of the persons who were least qualified to deal with it. He urged that houses which were in a condition of absolute filth should be shut up. With regard to that portion of the community who were incapable of earning more than 20/ a week, he thought that those who looked at the question fairly would grant that those people ought to be decently housed, even at the cost of a slight burden on the rates.

Dr John M'Vail said it was plainly evident that a Commission of some kind was necessary. This fact had been all the more strikingly brought home to them that night by the numerous and varied points which had arisen during the discussion originated by Professor Smart. There was, in fact, superabundant reason for a Commission of Inquiry. But there was one thing which should be very clearly emphasised. It seemed to him that the appointment of a Commission to-morrow by the Municipality would not be in the very slightest degree antagonistic to the carrying out of the present proposals by the Municipality, which he supported. The Corporation were to seek powers to borrow three quarters-of-a million for the erection of suitable houses for the poor, but he thought it was not likely that that amount would be spent all at once. There was, however, no likelihood of the whole sum, or even any considerable portion of it, being lost. They were to spend it on stone and lime for the purpose of obtaining rents, and as long as their Coat of Arms bore "Let Glasgow Flourish" there seemed to him no fear—whatever the Corporation might spend just now on housing—that the money would be lost. Professor Smart was right in assuming that the Improvement Trust—which has been trying to solve the problem for a generation—must have in its time accumulated an enormous amount of information bearing upon the subject—information of which the outside public knew nothing. Now that the public had come to take an interest in the matter, they were apt to ask what had the Corporation been doing? He doubted not that in the pigeon-holes in the Corporation Chambers there would be found answers to many questions raised in a meeting like this. The problem was so huge that it was hardly possible the Corporation had got hold of it from every point of view. Let the Improvement Trust go on with its work, and press forward equally with the Commission.

Mr George Eadie (builder), said he wished to know—possibly it was within the knowledge of those present—whether or not they had ever known a time in their experience in Glasgow when a decent tenant could not get a house in a decent tenement at a suitable rent. He was very much delighted with what Mr Motion had said. He had the same feeling—that there were not a thousand decent persons, however poor, who were left without a decent house. He had been in some slum tenements. Last summer he was in one which, on one side of a lobby had a house where everything was clean and bright and remarkably snug, while on the opposite side everything was squalid and miserable. Now he believed that, in the former case, there was perhaps more money going into the house, but the money went a wrong way. He was perfectly delighted with Professor Smart's address and was pleased with his reference to the sumptuary laws. A good house was an imperative necessary, whereas many things might be done without. The first essential was a comfortable, healthy house, so that the public might be protected. He (the speaker) was a builder, and had built houses in Glasgow, chiefly workmen's houses, for the last thirty years—possibly he had built over two thousand houses at rents ranging from £6 to £10. He had built those houses as a matter of business and profit, and he would not seek to build anything better. He had a very high opinion of the working-man of Glasgow; he was an excellent tenant. Nine-tenths of the working-men of Glasgow were decent and well-conducted, and lived happy and cleanly lives. But there was one difficulty, and that had not yet been raised. There was no ground that they could place them on in Glasgow. The Corporation were considerable holders of ground, and they restricted it to a certain class of property which the working-man could not pay for. There was no room for the working-man, go where they liked. Now he could, and he would, express only the very general feeling, not only of dissatisfaction, but of want of trust in the Improvement Trust of the City of Glasgow. He had watched the growth of the 1866 Act and its development, and he had read that Act and the others under which they carried on operations, and he could not find, within the four corners of them, any authority to build shops or places of business. The plea had been urged that the scheme was intended for better houses for the labouring classes; but, in the carrying out of that Act, he did not think there was such a house built. The Corporation of Glasgow had a strange fatality of going in for grand things—heroic measures—and they did nothing for the working man but profess to care for him on the hustings or the platform. The Corporation had really done nothing under the '66 Act, or their more recent Act of '97, that he could see, to help the poor working man to a better house. There were builders present that evening, and they would bear him out in saying that the houses built at present, without the aid of rates, would compare in quality, accommodation, and cheapness with anything the Corporation had yet produced. He had noticed that the Corporation were raising their rents £1, or something like that. He did not know any decent landlord who would raise rents on a sitting tenant in the way that the Corporation were doing. He considered it very unfair and very unusual. Private enterprise could work as cheaply and as actively as the Corporation did. Mr Motion had spoken with authority, but the Corporation had furnished them with no statistics as to the number of people who required to be lodged. From the Professor's notes, which he had observed in the newspapers, he gathered that some 2,250 small houses were unlet. He (the speaker) knew districts of the town where there were hundreds of dwelling-houses to let—rooms and kitchens, as well as single apartments. He had not yet seen any reason, or observed it put before the public, for this proposed action of the City Improvement Trust. It was not an Improvement Trust; it was really the City Building Trust.

Mr Hugh Mayberry said the question resolved itself into this: What was the remedy, and who was to carry it out? It would be familiar to most of those present, and especially to Mr Eadie, that, many years ago, the Improvement Trust entered upon a scheme of clearing away the slums. Unfortunately the situation of those slums was such that it was not possible, from a pecuniary point of view, that they could erect dwelling-houses that really were intended for the people who were leaving. Instead, business premises took their place; and it was only of late that the Improvement Trust had been facing the real object and intention of its existence, viz., the supply of a class of houses for the deserving poor. With all due deference to Mr Motion—who had given them a good deal of valuable information—there were thousands of deserving poor in Glasgow of whom the Parochial Authorities would never learn, and never were intended to learn. Therefore, he thought the Improvement Trust was fairly and legitimately face to face with its proper work, and face to face with an object without any prejudice to the private builders, for the reason that it would not pay the latter to provide it. Further, he thought he could say, without fear of contradiction, there were acres of land within the Parliamentary bounds of Glasgow which could be got at a price not exceeding 5s. per yard, and it was land of that value on which the class of houses could be built for what was termed the deserving poor. There was another point. When the

Railway Companies proceeded to disturb dwellings, the Board of Trade made it obligatory on them to provide an equal number of houses for those taken away. Now, it naturally followed that the Corporation had a similar obligation placed upon them. He did not say that Glasgow should settle that as a national question—every town should settle it for itself—but there was the obligation on the Corporation to build these houses for the class so often referred to.

Mr John Mann, jun., said the solution of the matter which was borne in upon him by his study of the question, was that they would have to do more than provide houses. They must introduce something in the nature of regulation, discipline, and control, which the private landlord at present very often omitted entirely. There were at present some 21,000 ticketed houses under the control of the Sanitary Authorities, because those places were a danger to the city. But they must not leave the Corporation to do all the work. He threw out the idea that the Corporation should co-operate with the Department which Mr Motion superintended—the Poor Law Authorities—and also, in a measure, with the Police, in dealing with the lowest units. The Corporation, in proposing to build on the outskirts, did so ostensibly to house the people who might be dispossessed by raising the standard of sanitary requirements in the city, but they had practically confessed that the people who were dispossessed in the centre of the city would not travel about 1½ miles or more to inhabit the beautiful new houses. Not only that, but the Corporation said they would not allow any but selected tenants to go into these houses. How then were they to re-house the dispossessed nethermost units?

The Corporation were deceiving themselves by the analogy of a pool of water into which a pebble was thrown—ever widening its circles. That analogy did not apply to the slums in the city. There was no fluidity in the slum population. If one slum was cleared the people were sent into and overcrowded another. It was not a pool of water but a black morass. The provision of new houses on the outskirts was not going to solve the problem. He was strongly impressed with the idea that they must build two new classes of houses—first, for selected tenants, the decent poor, second, for the rejected tenants, the dangerous and disreputable. Not Barracks by any means. That word, he thought, had crept in by an entire misunderstanding. When he brought the idea first before the Philosophical Society, he suggested, that the new type of house for the rejected tenantry be called Shelters. He would have houses for the decent poor as against shelters for the rejected tenants who had lost their characters. The latter would be semi-probationary houses to which entry would be obtained without "Factor's lines" and on a lower standard of conduct than any private builder could allow or tolerate. The people, however, must pay their rents and comply with fairly decent standards of order, although the caretakers might require to tolerate outbursts of drinking on a Saturday night, and that sort of thing. In such places any decent people there were would come to the surface and be lifted up by charitable agencies. They must provide some sort of a stepping-stone out of the mud. Ten years ago, in preparing a memorandum to the Town Council from the Workmen's Dwellings Company, he proposed that the Corporation should supply these stepping-stones by which the struggling poor might gradually get on to a higher standard of efficiency. Doubtless there would be some who would never come up to the light—they must just go their way—but there were numbers who, after serving their probationary period in the new houses, would rise through time. Such a scheme and such houses would form a benefit to the whole city, and on these lines the Municipal authorities were justified in building. In any event that there was an absolute need for thorough inquiry was clearly proved.

Mr James Finlay, junior, said he had known of respectable tenants leaving a property one by one without saying a word of complaint regarding their debasing neighbours. They were afraid to complain because their children or they themselves would be abused. These good tenants left and ultimately the factors could get nobody but the slum tenants to go into these houses. He had about 5,000 tenants, and of these nearly 3,000 paid rents ranging from £6 to £11. He was afraid that if they erected many of these cheap houses, all the young fellows, and all the country people, and ploughmen, would come into these cheap houses and get married.

Mr J. H. Kelly, said he had lived in a back land on the ground floor, and he had also lived in a ticketed house and been disturbed at night by a visit from the Sanitary Inspector, and he could appreciate all the remarks made. Truly some action was required, and an inquiry was necessary as to where to build houses and what class of houses was required. The houses required were partly those advocated by Professor Smart. He joined with those who had blamed the Improvement Trust for the manner in which they had taken up that building question. He thought that the lines they ought to go upon—if they were to go on building lines at all—were that they should put up houses that would suit those who were living in the lowest strata of society. The Municipality was evidently aware of this when it asked fresh powers for building purposes: it had been stated that the new houses would only be given to tenants of the poorest class. One member of the Council, in dealing with the question, said that the Corporation did not touch the nethermost unit of the community, and that the people who were being put out of the houses pulled down by the Corporation were the people who were refused houses by the Corporation. They were to go elsewhere and create new slums. The City Engineer had stated that houses could be built at 1s. per week. Now, all these were points to which the Corporation ought to give serious consideration before they put people out of houses and did not provide others at equivalent rents. Take the centre of the city; the Corporation had only one tenement where there were single apartments at £6 rents. They rather built houses of five apartments, which were obviously of no use to those people who had been dispossessed. He thought an inquiry ought to be pressed upon the Corporation. He was not in favour of the Corporation building, and he thought the Corporation had got good models in what the Workmen's Dwellings Company had done. He wished to add his tribute to Professor Smart for the energy he had shown in that matter.

Councillor Kennedy said the point to which they ought to have got an answer that evening was this:—Were they entitled to take down that slum property, and to act upon the powers that they possessed? He answered, Yes, on the ground of health. The next question was:—Should they not also make provision for the displaced? The remarks made to-night by Mr Motion deserved careful consideration. It had been his (the speaker's) painful experience during the short time he had been in the Town Council to have to pass an account of between £20 and £30 for repairs to a house they had built. What did they think that money was for? It was to make it sanitary—a house which the Corporation had built something like eighteen months ago! They had to spend this money to clear out the vermin. But there was one question which he should have liked Professor

Smart to have asked, and one which they ought to try and answer. It was not the question of high rents, but the question of low wages. Why should working men not have 20s. a week? The average was something like 16s. 10d. Why were they not making 20s. and so enabled to pay for the accommodation that one would like to see these people occupying? He granted that he did not know all the outs and ins of the matter, but he had gone there to learn a lesson, and regretted very much that none of them had attempted to answer that question.

Professor Barr, in closing the debate, said:—If the discussion had left one impression upon his mind he thought he could gather it from the remarks of Mr Shaw Maxwell—who had begun the debate—and Mr Kennedy—who closed it. Mr Maxwell asked Professor Smart for statistics as to the number of the vicious classes, and Mr Kennedy said that he came there expecting to find answers to the numerous questions which Professor Smart had asked. He thought if anything could be a stronger plea for the Commission which Professor Smart had so powerfully advocated they had it in the night's discussion—which showed so many questions still remaining to be asked and answered. The same plea might also be drawn from the case of one or two speakers—who apparently opposed Professor Smart's proposal—whose complaint seemed always to be that their questions had not been asked and answered. He therefore thought that the discussion would have done a very great service if it tended to promote the scheme which Professor Smart had put before them for a thorough inquiry. The questions were far too large to settle on a single evening, but he felt their discussion had not been in vain.

The proceedings then terminated with votes of thanks to Professor Smart and the President.

IX.—*Plague in some of its Historical and Present Day Aspects.*

By ROBERT MACNEIL BUCHANAN, M.B., F.F.P.S.G., F.R.S.E., Bacteriologist to the Corporation of Glasgow.

[Read before the Society, 19th February, 1902.]

INTRODUCTORY.

IT may be said that no disease at the present day compels so much attention and arouses the same general interest as Bubonic Plague. Although this country has happily been free from any visitation of it for a long period, historical accounts of epidemics have caused it to be regarded and dreaded as the most fatal of all diseases. The scientific interest in Plague has always been great and has been quickened enormously of late years by the discovery of the pathogenic agent, the bacillus pestis. Further it has always been a matter of international interest, and, as the modern systems of rapid transit between nation and nation have greatly increased the facilities for the possible spread of the disease, most of the European countries subscribed in 1897 to a sort of international confession of faith known as the Venice Convention, prescribing regulations designed to prevent the importation and exportation of Plague infection.

The majority of the epidemic ills that human flesh is heir to have of late years been sorted out and distinguished from one another with remarkable precision. But when we try to trace those diseases backwards to that limbo which is vaguely spoken of as "the dawn of history," their present day individuality becomes more and more indefinite, and many of them are lost to view, or only vaguely indicated. It is this historical vagueness that has led many to suppose that certain diseases are of quite recent origin.

The epidemic disease which I wish to bring under your notice this evening has a record which may almost be said to be contemporaneous with the dawn of history. Leprosy is the only disease which rivals Plague in historical antiquity. This historical antiquity of Plague indicates the possession of very pronounced characteristics. Its sign mark—the bubo—distinguishes it all through the ages. Again its mortality has always been conspicuous and was frequently so enormous that "it depopulated towns, turned the country into a desert, and made the habitations of men to become the haunts of wild beasts."[1]

HISTORICAL REFERENCES TO THE DIFFUSION OF PLAGUE.

Probably the very earliest reference to Plague is that to be found in the first book of Samuel, and referable to a period about eleven hundred years before the Christian Era. It is there stated that the Philistines had taken possession of the ark from the Israelites and had carried it to Ashdod. "But the hand of the Lord was heavy upon them of Ashdod, and He destroyed them and smote them with emerods, even Ashdod and the coasts thereof." The people of Ashdod evidently regarded this as a punishment for retaining the ark in their midst and petitioned their lords to have it removed from the city, and finally, as this emerod epidemic continued to visit the city with "a very great destruction" and "smote the men of the city both small and great," they craved that the ark be sent back to the Israelites in the hope of staying the pestilence. An indication of the deadly nature of this visitation may be inferred from the concluding sentence of the narrative—"and *the men that died not*[2] were smitten with emerods, and the cry of the city went up to heaven."

When we substitute "buboes" for "emerods" the biblical record may be accepted as containing exceedingly interesting and graphic allusions to Bubonic Plague.[3]

About nine hundred years later (*i.e.*, 280 B.C.), its presence again in the same region (Syria, Libya, and Egypt) is mentioned according to Hirsch in the 44th Book of the "Collectanea" of Oribasius, and very accurately described as an exceedingly acute and fatal pestilence characterised by buboes.

---

[1] Warnefrid—quoted by Hirsch in his Handbook of Geographical and Historical Pathology.

[2] The words in italics may be taken as indicating that the disease produced its most destructive effects in the extremely fatal pneunomic and septicæmic forms in which buboes are generally absent or inconspicuous.

[3] It is noteworthy as lending some support to this view that very pointed reference is made in the biblical narrative to "the mice that marred the land." It may very reasonably be assumed in the light of present day knowledge of plague as attacking some of the lower animals concurrently with man that the mice marred the land because they were smitten with the same Plague as the people.

In the 6th century (the actual year being stated as 542 A.D.), a great epidemic started from Egypt and spread northwards through Syria to Europe, and westwards along the African Coast. It embraced the whole Roman Empire to the east and west, and also spread far beyond the limits of Roman territory. The comparatively slow rate of diffusion in those 6th century days is indicated by the fact that the pestilence took forty-eight years to reach the Western Port of Marseilles. It is not known whether the disease existed in Europe previously, but this so-called Justinian Epidemic lasting as it did for half a century, gave Plague a footing in the Continent of Europe which it retained for eleven hundred years.

It is not however, until we come to the 14th century that Plague again figures prominently in history. In this interval of eight dark centuries it appears to have been mixed up with the severer kinds of epidemic disease, but its presence is vouched for by such names as "clades inguinaria," and "pestis bubonica."

The epidemic of the fourteenth century, known as the Black Death—probably the most destructive epidemic known to history—is supposed to have had its beginning in 1334 in China from whence it made a gradual progress overland by the caravan routes through India, Persia, and Asia Minor in the South and through Central Asia in the North to reach the shores of the Black Sea in 1347. It thus took thirteen years to progress stage by stage on its westward spread through Asia along the various leisurely overland routes of commerce of those days. Having reached the Black Sea its further progress westward received fresh impetus through the shipping which carried it quickly to Mediterranean Ports, so that within the next two years it had spread through the greater part of the Continent of Europe. It has been said that the loss of life in this epidemic is certainly unexampled in the history of pestilence, and in Europe alone it has been estimated at 25,000,000 or about one fourth of the population. In many cities more than one half of the population was swept away.

In the 15th, 16th, and 17th centuries many minor local epidemics occurred; in fact, it existed as a permanent form of disease in the Continent of Europe. The last pandemic of Plague which occurred in the 17th century covered a large portion of Asia, Africa, and Europe. In this country it culminated in what is known as the Great Plague of London in 1665, which accounted for 70,000 deaths in London alone. This malignant outbreak heralded the disappearance of Plague from this country for the long period of 235 years—a period of immunity that had led us to regard Plague as a thing of the past and as a disease purely of historical interest. From 1665 onwards it gradually receded eastwards in Europe with a tendency to linger in towns, and to flare up at times with all its destructive energy, as notably in Marseilles in 1720 and in Moscow in 1770—each city losing about 80,000 of the population. It did not finally quit the Continent of Europe until it died out in the Balkan Peninsula in 1841. It is not improbable that the present pandemic is the result of the outcrop on the seaboard of China of this eastward recession.

In the diffusion of Plague westwards it is evident that in all these epidemics the starting point for Europe was the seaboard forming the eastern shore of the Mediterranean and that while the disease seems to have been a very regular visitor in that part of the world its natural habitat was much further east in Central Asia and China.

ENDEMIC CENTRES OF PLAGUE.

From historical records it would appear that Plague clung to certain localities in different parts of the world from which at intervals it tended to spread outwards in epidemics and towards which these epidemics again receded when they had spent themselves. At the present day there are at least eight of these so-called endemic centres or areas recognised in different parts of the world, namely, the province of Yun-Nan in Southern China; Mongolia; the Trans Baikal region of Siberia; the southern slopes of the Himalayas in the provinces of Gahrwal and Kumaon; Mesopotamia; Assyr in Western Arabia; Benghasi in the North of Africa; and Uganda in British East Africa. It cannot be assumed that these have always been endemic centres of Plague, or that others did not exist. There is reason to believe that old centres became extinguished and new ones developed in the spread of Plague to and fro in epidemics. It may be inferred that those centres afford the natural conditions requisite for the perennial existence of the infection, but the manner in which it is perpetuated from year to year is a problem that is yet to be solved. It can only be asserted that it continues to survive amongst peoples and tribes whose primitive methods of living provide those insanitary conditions which exactly favour the incubation of infection. It is to be remembered also that the agency of some of the lower animals—especially rats and some other rodents—will be contributory under like conditions in keeping the virus from complete extinction.

THE ORIGIN AND SPREAD OF THE PRESENT PANDEMIC.

The starting point of the present pandemic of Plague is generally ascribed to Hong Kong. It could hardly have appeared in a place so ideally situated for its diffusion in view of its trading associations with every maritime nation in the world, and the question naturally arises, from whence did it reach this point. In this enquiry we again find our attention directed to the interior of Asia. In 1893, it began to move eastwards from the southern province of China called Yun-Nan, and traversed the intervening country by caravan routes to become epidemic in Canton in February, 1894. About the same time it reached Pakhoi, in the Gulf of Tonquin, by a more southerly route. Its transference to Hong Kong, naturally followed in due course, and that town was officially declared infected in May, 1894. It has retained its foothold there ever since with an average mortality of above 90 per cent. the latest reports indicating that there is no diminution, in virulence, but rather an increase.

From Hong Kong it has progressed steadily in a manner that at once indicates carriage of the infection from place to place by shipping. It made its appearance in India at Bombay in 1896, and meanwhile had spread extensively in China itself. Thereafter between 1899 and 1901, it rapidly gained a foothold in Japan, Philippine Islands, Sandwich Islands, New Caledonia, Mauritius, Madagascar, Persia, Mesopotamia, Arabia, Egypt, Mozambique, Portugal, South America, North America (San Francisco), Australia, Britain, and Cape Colony. Its arrival in these countries took place, generally speaking, in the order in which they have been named.

CHARACTERISTICS OF PLAGUE AS A DISEASE.

When an individual sickens with Plague he has symptoms similiar to those which generally characterise the onset of acute infectious diseases namely, shivering, high fever, headache, and sickness. Beyond this point, however, the patient may manifest the disease in one of four types, and as three of these types may simulate other diseases, it will readily be understood that at the beginning of a Plague Epidemic the existence of the disease may for a time be unsuspected. The varieties of type are the ambulant, the bubonic, the septicæmic and the pneumonic.

The "ambulant" type is apt to be overlooked because the feeling of illness is only of short duration, and the glandular swelling is so trivial that the idea of bubonic Plague may not be entertained.

In the "bubonic" type the sign mark of Plague—the bubo—proclaims the malady. The bubo is usually intensely painful owing to the rapid increase of the swelling, and is to be met with in the groin, armpit, or neck, though in seventy to eighty per cent. of the cases it is found in the groin. Buboes vary in size and are formed of one acutely inflamed gland, or group of glands, together with inflammatory swelling of the surrounding tissues. (Figs. 1 and 2.)

In the "septicæmic" variety the virus develops in the blood stream and there exercises its poisonous effect towards a rapidly fatal issue commonly without the production of any local symptoms which might serve to distinguish the illness from that of any other form of acute and rapidly fatal blood poisoning.

In the "pneumonic" type the virus invades the lungs causing a most acute and rapidly fatal inflammation of these organs. It is this type of the disease which proves so destructive in epidemics, not only because in itself it is one of the most fatal forms of disease known, but because the infection is readily spread from individual to individual by means of the expectoration.

In the last two types—the septicæmic and the pneumonic—buboes are usually absent or inconspicuous.

It may naturally be asked "Is there anything peculiar in the appearance of the Plague patient?" In the severe forms the countenance in the early stages usually depicts anxiety and distress, and in the later stages resignation and apathy. There is also reddening of the eyes, hesitating or indistinct speech, and if the patient is going about, his gait may be staggering like that of a drunken man.

The death-rate is a very variable quantity. In outbreaks (such as those of Sydney, Alexandria and Glasgow) where the disease is vigorously combated by repressive measures, and so prevented obtaining a high degree of virulence, the mortality is generally under 50 per cent., but where this early stage of invasion is allowed to pass and the disease becomes epidemic, the mortality ranges from 70 to 95 per cent. among persons attacked. The pneumonic form is generally responsible for this high death-rate.

THE DISCOVERY OF THE BACILLUS OF PLAGUE.

The outbreak of Plague in Hong Kong in 1894 will be memorable for all time, not only as the starting point of the present pandemic, but as affording the opportunity for bacteriological investigations which resulted in the discovery of the actual cause of the disease. The application of the modern methods of bacteriological research, by Kitasato of Japan and Yersin of France independently, brought to light the presence of a minute bacillus in the diseased tissues, and proved it to be the causative agent.

It was an epoch-making discovery, both from an administrative and a purely scientific point of view. As a result of it "Plague" ceased to be a convenient name for any obscure epidemic attended by great mortality. Precision if not absolute certainty has been given to the diagnosis of the disease. Preventive and curative remedies have been discovered, which have already demonstrated their effects in reducing mortality, and reason and force have been given to measures of prevention. It has also done much to dispel unreasoning dread of the malady, and to show that it is a disease capable of being held in check, and stamped out like other epidemics of the same class.

THE BACILLUS PESTIS IN THE BODY.

The outbreak in Glasgow afforded a very complete picture of the morbid anatomy of the disease. The lesions of Plague were all represented, although not perhaps in the exaggerated manner of epidemics of great virulence.

When fluid from a bubo was placed under the microscope, after being appropriately stained and mounted on a slide, the bacillus pestis was seen in great number as a small squat bacillus with rounded ends. The ends stain deeply in contrast with the centre, which may remain uncoloured. The immense numbers of the bacillus to be found in such a preparation, and the peculiarities of its size, form and staining are features so characteristic as to be almost absolutely diagnostic. When the bubo has existed for several days, the bacillus shows a degenerative tendency, losing its plump appearance and becoming irregular in size, stunted or elongated, ovoid or globular. At a later stage the bacillus disappears from the bubo, or may only be represented by dimly outlined or ghost-like forms, which can only be brought into view by intense staining. This rapid degeneration, it will be observed, is a fortunate circumstance, since by the time a bubo comes to discharge (which it need not necessarily do) the escaping material will be incapable of spreading infection, or at most possess only a low degree of infectivity. (Figs. 3 and 4.)

In a septicæmic case the bacilli are found in the blood, and distributed through all the organs of the body.

In pneumonic cases they are found in the lungs in enormous numbers, and consequently also in the sputum. The enormous number of the bacilli, and the powerful poison which they produce, cause not only a very acute but a very destructive and hæmorrhagic inflammation. This explains that spitting of blood which is so often mentioned in accounts of malignant epidemics, and no doubt accounts in some measure for the name "Black Death" given to the pandemic of the 14th century.

Sometimes the bacillus is associated with other microbes, notably the microbe of ordinary pneumonia, and the microbes of ordinary suppurative inflammations. This mixed infection tends to aggravate the illness. (Fig. 5.)

A peculiar tendency of the bacillus to develop in great colonies in various organs of the body was frequently seen. (Figs. 6 and 7.)

THE CULTIVATION OF THE BACILLUS IN ARTIFICIAL MEDIA.

Cultures of the bacillus are readily obtained from each case. On agar jelly the growth does not become visible until the second day of incubation at blood heat. Then a crop of minute greyish colonies appears and attains a maximum growth in about ten days.

Under the microscope the bacillus from a young culture is so little longer than it is broad, that it appears at first almost round. Subsequently it presents more of the form which it displays in the diseased tissues. (Fig. 8.)

In old cultures the bacillus tends to show a remarkable variation in form, becoming enlarged, globular, pyriform, or knobbed—an

PLATE III.

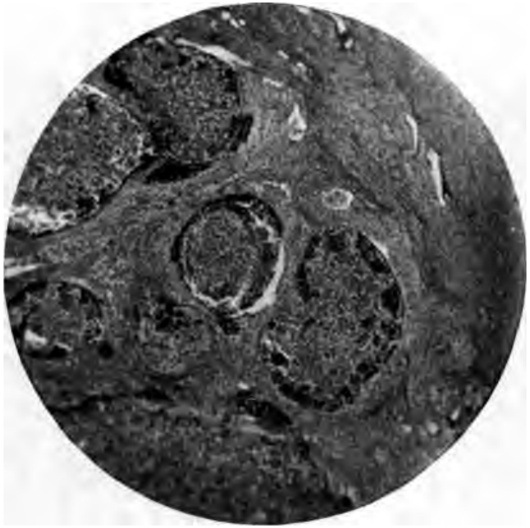


FIG. 1.—Cervical bubo, showing several lymphatic glands and ducts with plague bacilli massed in the periphery of each in enormous numbers (black in figure.) (Carbol-thionin-blue and Eosin.) × 60.

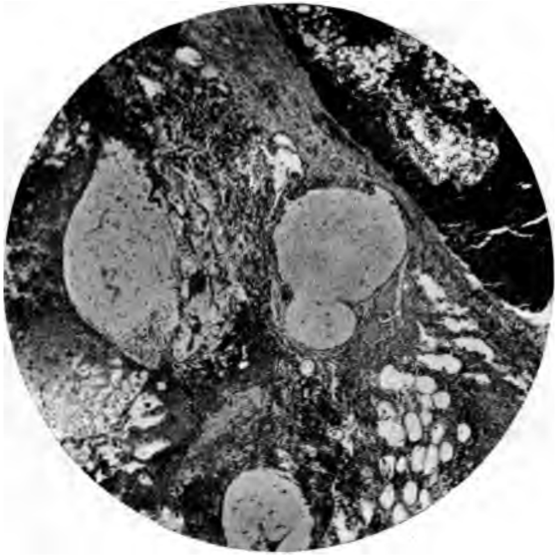


FIG. 2.—Margin of bronchial gland showing the fibrous capsule with three greatly distended blood vessels and a small portion of the periphery of the gland occupied by bacilli in almost homogeneous mass (black part in right side of figure.) (Carbol-thionin-blue and Eosin.) × 60.

PLATE IV.

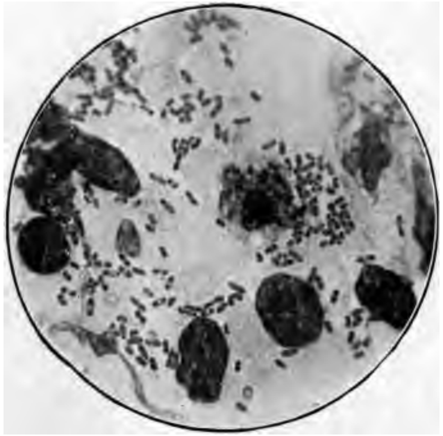


FIG. 3.—Bacillus pestis from spleen of infected mouse, showing the bacillus in very typical form and in active proliferation. (Carbol-fuchsin.) × 1000.

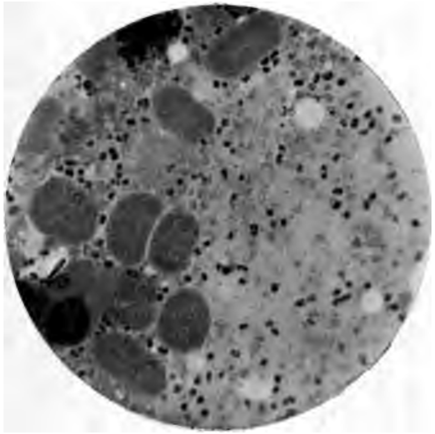


FIG 4.—Bacillus pestis from inguinal bubo. Shows the bacillus in process of degeneration and extinction. (Gentian-violet.) × 1000.

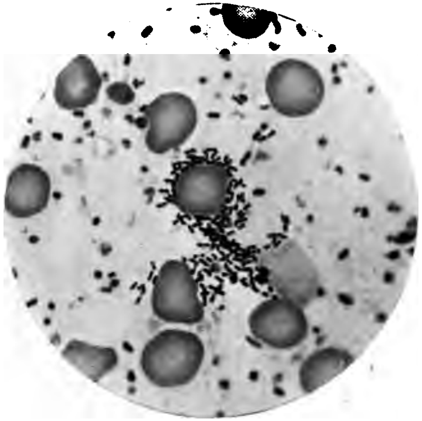


FIG. 5.—Bacillus pestis and pneumococcus from bubo to show mixed infection. (Corbol-fuchsin.) × 1000.

PLATE V.

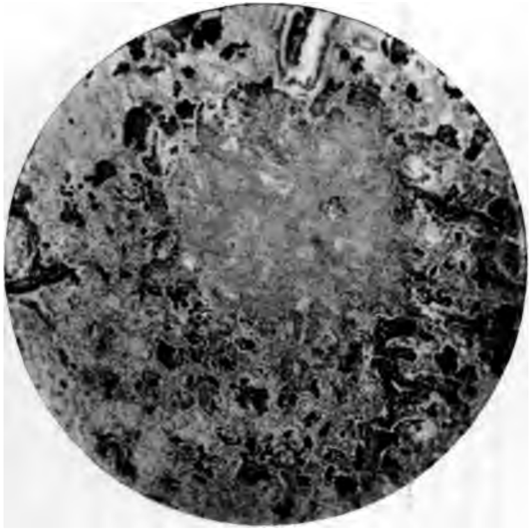


FIG. 6.—Section of lung showing an area of air vesicles which are occupied by dense masses of bacillus pestis (black in figure.) The central portion has undergone necrosis. (Carbol-thionin-blue.) × 60.

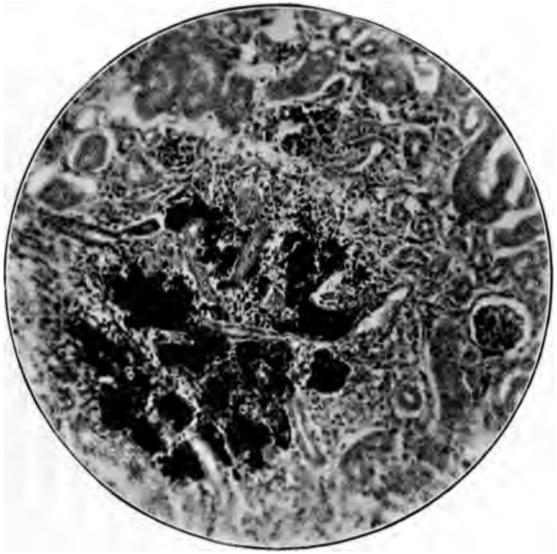


FIG. 7.—Section of kidney showing a portion of the cortex in which bacillus pestis has developed between the tubules in great masses. (Carbol-thionin-blue.) × 100.

PLATE VI.

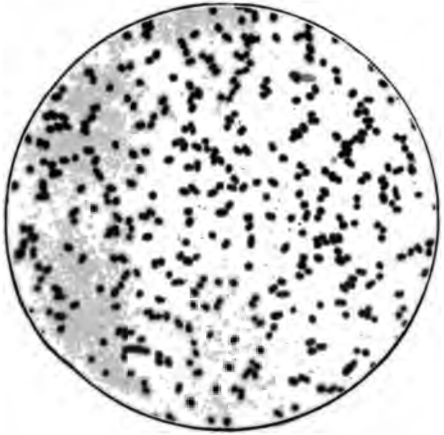


FIG. 8.—Bacillus pestis. Culture on agar after twenty-four hours. (Carbol-fuchsin.) × 1000.

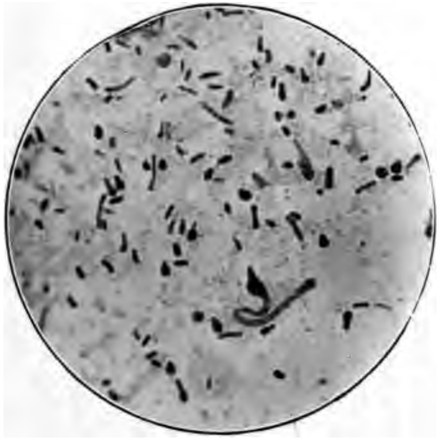


FIG. 9.—Bacillus pestis. Involution from a six weeks' old culture on ordinary agar. (Carbol-fuchsin.) × 1000.

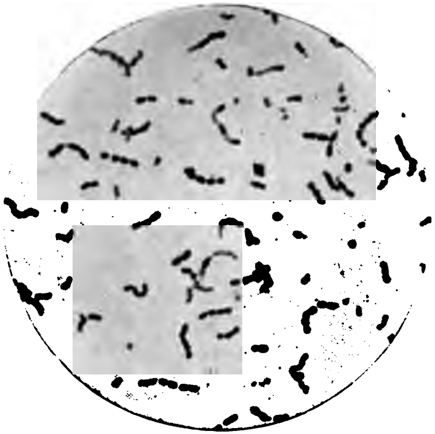


FIG. 10 —Bacillus pestis in chains. Culture in bouillon after four days. (Carbol-fuchsin.) × 1000.

exaggeration of the conditions mentioned as occurring in buboes in their later stages. (Fig. 9.)

In a fluid medium it appears in chains. All these variations of form assumed by the bacillus are valuable characteristics, which serve to aid in its identification when that is a matter of any doubt. (Fig. 10.)

TRANSMISSION OF PLAGUE INFECTION.

The manner in which the infection of Plague is transmitted from place to place, and from the sick to the healthy, as well as the conditions under which it maintains its existence apart from the human body, are questions which are naturally engaging very close attention at the present time, since accurate knowledge on all these points is essential to the evolution of efficient preventive measures.

Transmission of the infection from place to place is more readily observed in these days of rapid communication than in times past. The present pandemic offers, in its spread from port to port by shipping, a very striking contrast to the great pandemics of the sixth, fourteenth, and seventeenth centuries, which were mainly spread by overland caravan routes. This spread from place to place along the pathway of commerce is easily followed and easily understood, not only from what we know of Plague, but from our experience of other infectious diseases. On the other hand it is a very remarkable fact that the precise way in which localities have become infected has hardly in a single instance been satisfactorily or convincingly elucidated. The approach of Plague is not heralded by any outward or visible sign. It usually steals upon a place and may have obtained a considerable hold on a city ere its presence is suspected.

As most of us here present will remember, the announcement of its appearance in Glasgow in the autumn of 1900, was a rude shock not only to the city but to the whole country, and was received by some even with incredulity. Fortunately for Glasgow the outbreak was nipped in the bud, the cases numbering only thirty-six, with a mortality equal to fourty-four per cent. Its recurrence in the city in the following year was in perfect harmony with the natural history of the disease, which fully warranted the anticipation of this recrudescence. Fortunately again it was of very limited extent. The insidious manner in which the disease made its appearance is borne out by the fact that retrospective investigation proved it to have been present in the city for two or three weeks before it came under the notice of the authorities. In this respect the experience of Glasgow does not differ from other cities. In the extremely valuable report of the Indian Plague Commission recently issued, it is stated that the manner in which Plague was introduced into Bombay City in 1896, is very obscure and that even the exact date of the introduction cannot be ascertained. The first cases officially recognised were reported in September, but enquiries elicited the fact that it had been present as early as the month of July. In Alexandria an outbreak was officially recognised in May 1899, but it is alleged that cases of illness had been occurring for five months previously which, in the light of subsequent developments came to be regarded as cases of Plague. This outbreak is of special interest to us as bearing a close resemblance to the Glasgow one. The malady did not assume large proportions and was not the highly virulent type, only ninety-three cases being certified with a mortality of forty-eight per cent. It did not spread beyond the city, but it reappeared in the same month of the following year (just as it did in Glasgow), after a seeming absence from the city of five months. It is not a little suggestive that its reappearance was first observed among persons associated with a rag picking business.

Another feature of the entrance of Plague into seaport towns during the present pandemic, has been its appearance in the first instance amongst those employed at the docks or in warehouses in which imported merchandise is stored. This fact manifestly favours the theory of sea-borne infection. That such a mode of importation has to be constantly guarded against is amply borne out by the accompanying table (pp. 174, 175) which shows that cases of Plague have been carried to more than forty places since 1899, and dealt with successfully by the application of ordinary preventive measures.

The infection may be landed from a ship arriving from an infected port in three ways, namely, by individuals amongst passengers or crew who, at the time are incubating Plague or suffering from the disease in its mildest or ambulant form; by merchandise especially grain, clothes, and rags; and by Plague infected rats.

(1) The landing of persons affected in the matter I have indicated, would be almost impossible if it were known that any one of the ports of call was infected. A ship arriving from any

part of the world in which Plague exists, is always subjected to a very thorough scrutiny, and the crew are kept under observation.

(2) There has been frequent association of Plague outbreaks with imported grain, but the weight of evidence goes to show that the essential element in these outbreaks has been the presence of Plague infected rats. In almost every instance there is to be found a history of an unusual rat mortality preceding the appearance of Plague in those who handled the grain. In one case the dead rats were actually found amongst the grain, and were proved bacteriologically to have died of Plague. The frequent spread of infection traceable to clothes, and the occasional occurrence of outbreaks amongst people closely associated with rag stores, point to these articles as means whereby infection may also be landed from a ship.

(3) The importation of Plague by ship rats is not only possible but highly probable. Last year ships arrived from Plague infected ports at Bristol and Hamburg, and the ship rats were found to be stricken with the disease. Again a ship arrived at Hull from the Mediterranean with Plague amongst the crew, and it was ascertained that dead rats had been discovered in the ship shortly after she left Alexandria.

The spread of infection by rats from one place to another at a distance need hardly be considered except in reference to shipping, although there are several instances cited in the Report of the Indian Plague Commission, where it is probable that they were the means of transporting it from one village to another close by. The instrumentality of rats on the other hand in disseminating Plague within a town or village cannot be gainsaid. It might, of course, be asserted with plausible reason that the rodent receives the infection from man, were it not the rule to find the rats succumbing to the disease sometime prior to its appearance in man. Everywhere experience has served to show more and more clearly that Plague is primarily an epizoötic disease communicable to man rather than an epidemic disease communicable to animals. As Dr Manson has so well expressed it Plague is essentially "a ratborne disease," and our repressive measures should therefore be brought into line with this newly ascertained fact.

How the infection passes from the rat to man is still a matter of some uncertainty. But this uncertainty does not warrant the scepticism with which this subject is apt to be, and is being regarded. There is absolutely no doubt about the identity of the

THE DIFFUSION OF BUBONIC PLAGUE FROM 1893 TO 1901.

Places infected with Plague are printed in Capitals. Places to which Plague was transported and recognised before having a chance of dissemination are printed in ordinary type.

Year.	Asia.	Europe.	Africa.	Australia and Polynesia.	South America.	North America.
1893.	YUN-NAN PROVINCE (Southern China).					
1894.	CANTON & PAKHOI. HONG KONG.					
1895.	AMOY. FU-CHOW. POCHIN. SWATOW. MACAO. HOI-HOW. TONQUIN.					
1896.	CH'AO-YANG. HAIMEN. KIUNG-CHOW. FORMOSA. BOMBAY. BOMBAY PRESIDENCY.	London.				
1897.	GWALIOR (KHANDRAONI). LOWER DAMAUN. N. W. PROVINCES. Madras. JEDDAH. MECCA.					
1898.	CULAO. NHATRANG. CALCUTTA. PUNJAUB. HYDERABAD. MYSORE. MADRAS PRESIDENCY. Kamaran. ADEN. GWADAR. SAMARAKAND.	Vienna.	MADAGASCAR. LORENZO MARQUES.			

1899.	NEW-CHWANG. OSAKA. KOBE. HAKATA. SINGAPORE. PENANG. CENTRAL PROV. (India) BENGAL. MATTRA. Mecca. MUSCAT. Lohaia. JASK. Basra. BUSHIRE. Beyrout.	OPORTO. Lisbon. Barcellos. Trieste. Plymouth. Barcelona. KOLOBOWKA. KRASNOYARSK.	MAURITIUS. REUNION. GRAND BASSAM. ALEXANDRIA. Zanzibar. Cape Town. MOZAMBIQUE.	NOUMEA. HONOLULU. Adelaide.	SANTOS. SAO PAOLO. ASUNCION. ROSARIO.	New York.
1900.	Yokohama. Ikeda. NAGASAKI. MANILA. RANGOON. KICHM. ADEN. YAMBO. BEYROUT. SMYRNA. TREBIZOND.	Hamburg. Bremen. Constantinople. Marseilles. Liverpool. Cardiff. GLASGOW. London. Hull.	SUAKIM. Durban. Damietta. PORT SAID. Cape Verd Is. Cape Town. KING WILLIAM'S TOWN	SYDNEY. MELBOURNE. FREEMANTLE. IPSWICH. BRISBANE. MARYBOROUGH. BUNDABERG. ROCKHAMPTON. CHARTERS TOWERS. TOWNVILLE. CAIRNS. Auckland.	RIO JANEIRO. PETROPOLIS. NICTHEROY. BUENOS AYRES. Montevideo.	Port Townsend. SAN FRANCISCO.
1901.	Wu-Sung. Singapore. Beyrout.	Hull. Shields. CARDIFF. Bristol (Rats). Southampton. Plymouth. LIVERPOOL. London. Gravesend. CONSTANTINOPLE. Marseilles. NAPLES. Hamburg (Rats). ODESSA.	CAPE TOWN. Durban. PORT ELIZABETH. ZAGAZIG. MANSOURAH. MINIEH. BENHA. MITGHAMR.		S. Nicolas.	

disease in the rat and in man and the opportunities which a rat has for distributing infection in food, and in the air of a dwelling cannot lightly be lost sight of. In various recent outbreaks the pestilence appeared among the rats first, and it has been known to exterminate them almost completely ere it made much headway amongst the inhabitants. It is in this early stage that the greatest danger from rat infection lies, for after that the disease is mainly spread amongst the people by the people themselves.

There has been much controversy over the question of the transmission of infection by fleas from Plague stricken rats. That such a mode of infection may take place is quite possible in view of the fact that a flea from a Plague stricken rat may show enormous number of Plague bacilli in its stomach. When mosquitos through their bites can inoculate a man with malaria, it is not too much to surmise at least that the flea is likewise capable of inoculating the Plague bacillus, an organism much smaller than the plasmodium malariæ. There is no doubt whatever that fleas do actually pass from the dead rats to persons coming into close contact with them, and that they may also bite these persons.

PROTECTIVE INOCULATION.

For those who are to be closely associated with Plague patients or engaged in any capacity that brings them within range of possible infection, the most important preventative measure in addition to the exercise of scrupulous cleanliness, and the maintenance of vigorous health is protective inoculation by Haffkine's Vaccine. The vaccine is prepared from cultures of the Plague bacillus which have been carefully incubated for five or six weeks and then sterilised. The dose is about 2 c.c. injected subcutaneously. Experience of this method of vaccination against Plague in India, where opportunity has been amply afforded for testing its protective value, goes to show that it has had a considerable effect in warding off Plague attacks from the inoculated, and in rendering attacks among the inoculated less fatal than attacks among the uninoculated.

TREATMENT OF PLAGUE.

The treatment of Plague has been revolutionised by the discovery of the Plague bacillus. Formerly treatment was wholly directed to the relief of the patient's symptoms as in any other disease. Blood letting was extensively resorted to in olden times

—a method of treatment that was probably, from what we now know, many times responsible for the spread of the infection.

To-day while the relief of symptoms, and the sustaining of the natural powers of the patient are in the forefront of treatment as formerly, the object aimed at in treating a Plague patient is the neutralisation of the poison which has been developed in his system by the Plague bacillus. This object has been attended with the most brilliant results by the use of the curative serum for which we are indebted to Yersin, one of the Bacteriologists who discovered the bacillus at Hong Kong. The serum is obtained from the blood of the horse, just as in the preparation of the curative serum for Diphtheria, the only difference being that the Plague bacillus is used for the one, and the Diphtheria bacillus for the other in the preparatory inoculation of the horse.

One condition of success is, that the serum should be used in large doses, and injected directly into the blood stream.

This system of treatment was in danger of falling into disrespect a few years ago, because the quantities used were far below the amount now regarded as necessary to exercise a complete neutralising effect on the Plague poison in the patient's body.

DURATION OF PANDEMIC.

The question of the duration of the present pandemic is one of great interest and importance. It is not brought forward with any idea of indulging in prophetic speculations, but for the purpose of stimulating discussion and drawing attention to some points that at least indicate the trend of events. The epidemic emerging from China at Hong Kong in 1894 has become a pandemic, and while repressive measures have succeeded in keeping it in check in many places it has nevertheless gained a footing in different parts of the world to an extent and with a rapidity unexampled in history. In towns with efficient sanitary administration it cannot conceivably make much headway, unless local circumstances enable it to assume the pneumonic form, nevertheless it has shown a tendency to cling to places which have become infected and to recur year after year at a certain season. This has been seen in such places as Hong Kong, Bombay, Calcutta, Sydney, and Glasgow. In Hong Kong the disease has been present for seven years, and is to-day as virulent as ever. In Bombay it has been active for five years, and in Calcutta for four years. Sydney has had time to show two recurrences, and Glasgow one. It may therefore be accepted that once a centre becomes infected it is liable to have several recurrences, and if we consider that at least several fresh centres will crop up in different countries each year for some years to come, then it appears that a possible visitation of the disease will have to be provided against for a very considerable period by any seaport admitting foreign traffic. The disease in short will have to be placed in line with those other unwelcome visitors—small-pox and typhus, and be provided against with the same careful foresight.

The pandemic will no doubt gradually subside as others have done before, by the disease being driven to the interior of Continents by the active repressive measures of the more civilised nations, but before this can be accomplished there is reason to believe that it will continue to menace the commercial pathways of the world for at least five-and-twenty years. That Plague will ultimately disappear from the face of the world may be confidently anticipated, but it will only be when civilising influences have extended to those benighted endemic centres to sweep away the conditions which foster its perennial growth.

The paper was illustrated by the following lantern slides:—

Table showing the Diffusion of Plague, since 1893.
Map of World showing Endemic Centres of Plague.
Map of India showing spread of Plague:—
    (1) from 1896 to 31st March, 1897;
    (2) from 1st October, 1898, to 31st March, 1899.
Bubo in groin.
Bubo in neck.
Bubo from groin in section.
Bubo from neck in section.
Cervical bubo—under low power.
Mediastinal bubo—under low power.
Bacillus pestis from spleen of mouse.
Bacillus pestis from bubo—recent.
Bacillus pestis from bubo—degenerate.
Bacillus pestis from blood.
Bacillus pestis from lung.
Bacillus pestis from lung—mixed with other organisms.

Plague Pneumonia—showing bacilli.
Plague Pneumonia—showing necrosis.
Liver with Plague foci—low power.
Liver with Plague foci—high power.
Kidney with Plague foci—low power.
Kidney with Plague foci—high power.
Culture on agar.
Bacillus pestis from agar culture.
Bacillus pestis involution forms.
Bacillus pestis in chains.
Bacillus pestis from rat.
Bacillus pestis from mouse.
Bacillus pestis from cat.
Bacillus pestis from guinea-pig
Section of flea.
Bacillus pestis in stomach of flea.

X.—*Joannes Matthæus and His Tract "De Rerum Inventoribus."* By JOHN FERGUSON, M.A., LL.D., F.R.S.E., etc., Professor of Chemistry in the University of Glasgow.

[Read before the Society, 4th December, 1901.]*

1. THERE is an Italian author of the sixteenth century who wrote a small treatise on the original inventors of various things. His name was Joannes Matthæus Lunensis. His book was edited by Agostino Giustiniani, Bishop of Nebbio, in Corsica.

2. There is another Italian author of the same century, who wrote odes and hymns, and a translation of the psalms in Latin verse. His name was Joannes Matthæus Toscanus. Some of his works are said to have been edited by Jean Dorat (Joannes Auratus), the Court poet of France.

3. Is there here one man under two different appellations, or are they two different men? In other words, are the epithets "Toscanus" and "Lunensis" synonymous? The question is legitimate, for the persons have been identified or confused by some writers, while, by others, they have been practically, if not explicitly, distinguished.

4. The first reference to the book about inventors I met with was that by Beckmann,[1] and, without having seen a copy of it, I mentioned it on his authority.[2] Subsequently, I found one in Sir William Hamilton's collection (now in the University Library, Glasgow), and gave a notice of it and of its author.[3]

On that occasion I accepted what had been said about him by Jöcher, to whom Beckmann refers, unaware of any possible difficulty in the matter. But, having had cause subsequently to dis-

---

[* The first draft of this paper was read to the Bibliographical Society of Edinburgh, 11th January, 1900. It was afterwards elaborated in detail, and entirely re-written.]

[1] *Beyträge zur Geschichte der Erfindungen*, Leipzig, 1792, III. p. 559.

[2] "Notes on some Books of Receipts," . . . in *Transactions of the Archæological Society*, Glasgow, 1883, II. p. 232.

[3] *Ibid.*, 1896, N.S. II. p. 369.

trust Jöcher on this point, I have become doubtful of the accuracy of the account of Joannes Matthæus which I formerly wrote, and I intend now to re-examine the whole subject.

5. Jöcher[4] states that Joannes Matthæus, a native of Tuscany, was the author of a tract *De Rerum et Artium Inventoribus*, edited by Augustinus Justinianus, of a translation of the psalms into Latin verse, and of original odes, hymns and poems in Latin, which were edited by Joannes Auratus. There can be obviously no uncertainty about Jöcher's opinion.

In an attempt to discover something more about the author of the tract *De Rerum Inventoribus*, I failed to find his name in the later biographical dictionaries, and thus learned that he and his book are practically forgotten. Accordingly, I turned to writers prior to Jöcher, and soon ascertained that they are by no means concordant. It may, therefore, be as well at this point to collect and compare the different statements.

6. The name Joannes Matthæus, both with and without a qualifying epithet, is not uncommon. There is a Joannes Matthæus ex Ferrariis, or de Gradibus, "philosophus insignis, medicus illustrissimus," as he is styled by Gesner, in the middle of the fifteenth century. He wrote commentaries on Rhazes and Avicenna. A theologian, who wrote commentaries and controversial works on theological questions, towards the end of the sixteenth century was known as Joannes Matthæus Smalcaldensis. He was a professor at Wittemberg, and died September 18, 1588.[5] Another physician and author was Joannes Matthæus Hessus, whose books appeared in the early years of the seventeenth century. Besides these, there are the two authors now under consideration, Joannes Matthæus Lunensis, and Joannes Matthæus Toscanus, to whom may be added a certain Matthæus Toscanus.

With the first three there is no difficulty. They are easily distinguished from each other, and from the other three, and as they have no bearing on the present question, they need not occupy us any further.

7. The earliest mention of Joannes Matthæus Lunensis, of which I am aware, is in the appendix to Conrad Gesner's *Bibliotheca*, where there is ascribed to him the work *De Mulieribus*

---

[4] *Allgemeines Gelehrten-Lexicon*, Leipzig, 1751, III. col. 287-8.

[5] Freher, *Theatrum Virorum Eruditione Clarorum*, Norib. 1688, I. p. 274.

Claris, published at Paris in 1520.[6] Reference will be made to this book further on. The *Libellus De Rerum Inventoribus* is not included, and as for the name of Joannes Matthæus Toscanus, it does not appear in it till the edition of 1583, when he is spoken of as the author of a translation of the psalms.

8. Next in order of time is Georgius Draudius, who certainly draws a distinction between the two writers. Under Joannes Matthæus Lunensis he places[7] the tracts about inventors and about famous women, but he gets into some confusion over the other, for he ascribes to Joannes Matthæus Toscanus the translation of the psalms,[8] the collection of Italian poets who wrote in Latin,[9] and the *Anthologia Epigrammatum*,[10] although the compiler of this last work is called Matthæus Toscanus simply, and not Joannes. As for the *Peplus Italiæ* he has got its author's name wrong, for he styles him Joannes Maria Toscanus.[11] This same error crops up subsequently.

9. Notwithstanding these entries by Draudius, Hallervord[12] puts the *Libellus De Rerum Inventoribus*, 1520, and the *Peplus Italiæ*, 1578, under the same author, whom he terms Joannes Matthæus Lunensis, with the additional epithet "Hetruscus," which, though more general, comes practically to the same thing. This is as plainly an identification of the two authors. The epithet *Hetruscus*, it may be remarked, was never employed by either Matthæus Lunensis or Toscanus.

10. König's[13] article is almost a copy of the preceding. He, too, styles Matthæus "Lunensis, Hetruscus," and makes him author both of the *De Rerum Inventoribus*, 1520, and *Peplus Italiæ*. But under Toscanus,[14] whose name does not appear in Hallervord's list, he puts the metrical version of the psalms, 1596, but not the

---

[6] *Bibliotheca Universalis*, Tiguri, 1545, Appendix, f. 67 *verso*. The same entry is repeated in the subsequent editions of 1555 (Paralipomena) p. 184; 1574, p. 394; 1583, p. 394. For Toscanus, see 1583, p. 471.

[7] *Bibliotheca Classica*, Francofurti ad Moenum, 1625, I. p. 1155 and p. 1189 (misprinted 1198).

[8] *Ibid.*, II. p. 1586.

[9] *Ibid.*, II. p. 1521 and 1558. In the former of these the name is misspelt *Tossanus*, which might make a confusion with a Petrus, a Daniel, and a Paulus Tossanus, all of whom are known.

[10] *Ibid.*, II. p. 1534.

[11] *Ibid.*, I. p. 1285.

[12] *Bibliotheca Curiosa*, Regiomonti et Francofurti, 1676, p. 189.

[13] *Bibliotheca Vetus et Nova*, . . . à Georgio Matthia Könிgio, Altdorfi . . . 1678, p. 519.

[14] *Ibid.*, p. 815.

Peplus, so that his statements about these authors conflict with those of Draudius.

11. The entries in the catalogue of the Barberini library explicitly discriminate between our authors. Under Matthæus[15] appears the *De Rerum Inventoribus*, 1613, and under Toscanus[16] the *Carmina*. It is true that to Matthæus are apparently ascribed also certain medical tracts which were written a century later by J. Matthæus Hessus, but that confusion is easily rectified, and does not concern us now.

12. A variation on the preceding entries was introduced by Antoine Teissier,[17] who distinguished the two in a different way. He names them both Joannes Matthæus, but to one he gives the epithet *Lunensis*, to the other *Toscanus*, which he evidently regards as a mere adjective, and not as an essential part of the name. Under Lunensis are given both the *Libellus De Rerum Inventoribus*, 1614 (*sic*), and *Opus De Mulieribus Claris*, 1520, but no mention is made of a 1520 edition of the former tract.

The *Peplus Italiæ*, 1578, is ascribed to Toscanus, and there is quoted, on Ph. Labbe's authority, a copy with additions and corrections in the author's hand, in the possession of Raphaël Trichet Dufresne, "*qui Bibliothecam Historicorum Italiæ magno studio adornabat.*" The other works of Toscanus are not referred to because they did not come within the scope of Teissier's list. Apparently, while discriminating between these authors, he has not quite grasped the real ground of difference.

13. Only the tract *De Rerum Inventoribus*, by Jo. Matthæus Lunensis, misdated 1620, is mentioned by Jacob Friedrich Reimmann,[18] who, moreover, warns his readers not to confuse him with Joannes Matthæus Smalcaldensis.

14. Zedler, also, quoting Hallervord, mentions only the *Peplus Italiæ*, 1578, and *De Inventoribus Rerum*, 1520 and 1613, and assigns both to Lunensis.[19] But Zedler has also an article[20] under

---

[15] *Index Bibliothecæ qua Franciscus Barberinus . . . Magnificentissimas suæ Familiæ ad Quirinalem Ædes magnificentiores reddidit.* Romæ, 1681, II. p. 43.

[16] *Ibid.*, p. 473.

[17] *Catalogus Auctorum qui Librorum Catalogos, Indices, Bibliothecas, Virorum Litteratorum Elogia, Vitas, aut Orationes Funebres, Scriptis consignarunt.* Genevæ, 1686, 4to, p. 190.

[18] *Versuch einer Einleitung in die Historiam literariam antediluvianam*, Halle im Magdeb. 1709, p. 213.

[19] *Universal-Lexicon*, Leipzig, 1739, XIX. col. 2105.

[20] *Ibid.*, 1745, XLIV. col. 1613.

'Toscanus,' whom he credits with the *Anthologia Epigrammatum*, 1619, and *Peplus Italiæ*, 1658 (*sic*).

Zedler's double entries indicate either forgetfulness on the part of a single author of the two paragraphs, or else emanation from quite different writers, but, anyhow, as they are full of confusion, they have the effect of increasing the obscurity, and contributing to the identification of the two writers which we find at last completed in Jöcher.

15. In speaking of the *Peplus Italiæ*, 1578, Jo. Albertus Fabricius[21] ascribes it to Toscanus, and makes no reference to any other works either by him or by Lunensis. He repeats what is said by Teissier about a copy with the author's emendations, but adds that he could not discover what had become of it.

16. Though Jöcher identifies the two authors as far as their works are concerned, he does not style the writer either Lunensis or Toscanus; perhaps he was bothered by the conflict of authorities, was not sure about the epithets, and thought it most judicious to drop them entirely. He commits the mistake, also, of calling him Matthæi, instead of Matthæus, but he evidently looks upon that as his family name. Jöcher enumerates only the *Libellus De Rerum Inventoribus* 1520 and 1613, and *Psalmi Davidis . . . hymni et poemata*, Paris, 1576.

17. Lessing,[22] who has devoted a section to the author of the *De Rerum Inventoribus*, follows Jöcher as to his having written poems edited by Joannes Auratus, but he, too, avoids the epithets Lunensis and Toscanus.

18. Even Beckmann,[23] who is so careful in general, has taken Jöcher's statement for granted, and assigned the authorship of the *Peplus Italiæ*, as well as of the Latin poems, to Joannes Matthæus Lunensis.

19. Singularly enough, while Graesse has omitted both authors from his great catalogue,[24] he has mentioned and clearly distinguished them in his *Literärgeschichte.* Toscanus, whom he too misnames Maria, was, he says, a native of Milan, known by poetic biographies of his contemporaries, and Graesse refers to the *Peplus*

---

[21] *Conspectus Thesauri Litterarii Italiæ*, Hamburgi, 1730, p. 285.

[22] *Kollektaneen zur Literatur*, Berlin, 1790, II. pp. 142-145.

[23] Sup. § 4, note 1.

[24] *Trésor de Livres Rares*, Dresde, 1859-1869.

Italiæ, Lutet., 1578, 8vo, and the reprint by Fabricius, *Consp. Ital.*, p. 369.[25]

The other he calls Johann Matthæus, of Luna, in Tuscany, who wrote on the history of inventions, mentioning the Paris edition of 1520, and that of Hamburg, 1613.[26]

It is obvious that Graesse not only considered them as quite distinct, but as having different names, the poet being called Toscanus, the historian Matthæus, thus differing from Teissier and Jöcher.

20. From these extracts it will be seen how much uncertainty envelopes the individuality of these writers. None of the authorities (except perhaps Draudius), gives a full list of their respective works if they were believed to be different, or collectively if they were believed to be identical.

It is also worth remarking that they are neither of them mentioned by writers on rare books. Either their works were so rare that they were not known at all, or else they were not considered of sufficient importance to be noticed.

When, therefore I identified these writers,[27] I followed what I thought were sound authorities, and omitted to subject them to the scrutiny which the foregoing comparison proves plainly was necessary. If I erred, it was, truly, in respectable company, but that is no excuse for not having made sure of my guides.

21. The two authors may now be specially considered. Of Joannes Matthæus Toscanus, who, for convenience, may be called simply Toscanus, there is the briefest notice in the biographical dictionaries and histories.

Tiraboschi[28] speaks of him as Giammatteo Toscano, a Milanese, who lived a long time in France. De Angelis[29] possibly simply copying Tiraboschi, says he was born at Milan, adding that it was towards the end of the fifteenth century, but no year is mentioned. Graesse,[30] in turn, repeats that he was a Milanese. Peter Burmann,[31] referring to a promised third volume of Italian poets, which, however, never appeared, calls him Joannes Matthæus Toscanus. So, too, Crescimbeni,[32] who quotes both the *Peplus Italiæ* and the *Carmina Poetarum Italorum* more than once, calls the author Toscanus, with or without his christian names. All these authorities seem to me to consider that Toscanus, whatever it may have signified originally, was his family name, and not a mere birthplace appellation, as it was certainly regarded by Teissier, and must have been by Jöcher.

---

[25] *Lehrbuch einer allgemeinen Literärgeschichte.* . . . Leipzig, 1852, V. p. 1214, and p. 1226, note 107.

[26] *Ibid*, 1853, VI. p. 789, and p. 790, note 2.

[27] Sup. § 4, note 3.

[28] *Storia della Letteratura Italiana*, Firenze, 1812, VII. iii. p. 1025.

[29] *Biographie Universelle*, Paris, no date, XLII. p. 2.

[30] Sup. § 19, note 25.

[31] Infr. § 25.

22. His writings are well known. The following, which I have seen, form, I believe, a complete list.

1565. Adr. Tvrnebi | Ad Academiam | Parisiensem | Προσωποποιΐα | *Auctore Io. Matthæo Toscano Romano.* | [Device.]
Parisiis | *Apud Thomam Richardum, sub Bibliis aureis,* | *è regione collegij Rhemensis* | 1565. |

Small 4°. A in fours. Aj, Title leaf; Aij *recto*, folio 2, Text of the poem begins; it ends Aiij *verso*, folio 3; Aiiij is blank.

This is one of the multitudinous elegies called forth by the death of the famous professor of Greek, at Paris. It is included in the author's collected poems, 1575, p. 55, but this 1565 edition is not quoted by the bibliographers.

23. 1575. Psalmi Davidis ex hebraïca veritate latinis versibus expressi. . . . Quibus præfixa sunt Argumenta singulis Distichis comprehensa, opera Io. Aurati Poetæ Regij.[33]
Parisiis. Ex Officina Federici Morelli . . . 1575. 8vo.

The edition cited by Draudius (*Bibliotheca Classica*, 1625, II. p. 1586), has the date 1576. That by König (*Bibliotheca Vetus et Nova*, 1678, p. 815), has the date 1596. I suspect this is a misprint. I have seen no other reference to a copy of this date.

24. 1575. Octo Cantica Sacrae Sacris Bibliis latino carmine expressa . . . præfixis argumentis Io. Aurati Poetæ Regij. Ejusdem Toscani Hymni et Poemata. . . .
Parisiis. Ex Officina Federici Morelli . . . 1575. 8vo.

This volume contains paraphrases of the songs of Zacharias, Anna, Simeon, etc., hymns, epigrams, and odes. Draudius quotes an edition of 1576, and so does Jöcher, possibly a re-issue with a new title page.

---

[32] *L'Istoria della Volgar Poesia scritta da Gio. Mario Crescimbeni*, Venezia, 1731. 4°.

[33] Olaus Borrichius, who has just a line to spare for Jo. Auratus (*Dissertationes Academicæ de Poetis*, Francof. 1683, 4° p. 111), does not mention Toscanus among either Italian or French poets.

The statement that the psalms, hymns, and odes were edited by Joannes Auratus (Jean Dorat) (§ 2), seems to have originated with Jöcher by a misunderstanding of what Auratus really did, which was simply to prefix the arguments to the psalms and odes in the form of a couplet. The only other writer who either repeats Jöcher or makes the remark afresh is De Angelis, who says of the psalms:—"Ce dernier ouvrage fut publié par Dorat son ami, dont il se vantait d'être l'élève. Il l'avait connu à la cour de Catherine de Médicis, dont il fut particulièrement le protégé."

25. 1576-77. Carmina Illvstrivm Poetarvm Italorvm. . . . Tomvs Primvs.

Lvtetiæ. Apud Ægidium Gorbinum. . . . 1576. . . .
Id. Tomvs Secvndvs. 1577. 16mo.

Apparently there was to have been a third volume, but it never appeared.[34]

26. 1578. Peplus Italiæ. Io. M. Toscani Opvs, in quo illustres viri . . . (quotquot trecentis abhinc annis tota Italia floruerunt) eorumque patriæ, professiones, & litterarum monumenta tum carmine tum soluta oratione recensentur.

Lvtetiæ. Ex Officina Federici Morelli. . . . 1578. 8vo.

Draudius (I. p. 1285), puts the imprint and date in his wonted curtailed fashion: "Lutet. ap. Morel, 58," meaning 1558. This is, of course, a misprint for 78, that is, 1578, but it has had the effect (so prolific is inaccuracy) of producing another blunder. For, in his article on Toscanus, Zedler (sup. § 14) assigns to this book the date 1658, referring also to Fabricius' reprint. This date, 1658, is Draudius's original misprint, writ large, and misinterpreted by a whole century. The culmination of the confusion and the vengeance upon the blunder are to be found in Zedler's article on Joannes Matthæus (Lunensis). For there, where the *Peplus Italiæ* has no business to be, as not having been written by Matthæus, it is correctly dated 1578.

27. 1722. Toscanus' poems were reprinted in a collection entitled: *Carmina Illustrium Poetarum Italorum*, Florentiæ, MDCCXXII. 8vo.

They are contained in Vol. IX., pp. 283-387, and are reprinted from the edition of 1576.

28. 1730. The *Peplus Italiæ* was reprinted from the 1578 edition by Jo. Alb. Fabricius at the end of his *Conspectus Thesauri Litterarii Italiæ*, Hamburgi, 1730, 8vo. It occupies pp. 369-531 of this volume. The

---

[34] *Anthologia Veterum Latinorum Epigrammatum et Poematum*, by Petrus Burmannus, Jr. Amstel, 1759, I., p. xiv.

remainder of this edition re-appeared at Hamburg, 1749, with a new title page, and with the epistle and contents reprinted.

In the preface addressed to "Antonius Ebrardus Sansuplicianus Episcopus et Comes Cadurcensis," Toscanus refers to the collection of Italian poets already published by him, the aim of which was not only to celebrate his own countrymen, but to stir up others to do the same for theirs. And now, with a similar motive, he published the present collection.

The *Peplus Italiæ* is rather an interesting piece of work, and affords one or two items bearing upon the present discussion. It consists of four books of epigrams on distinguished men of Italy, from Dante to Joannes Carga, a period of three hundred years. There are 200 epigrams in all, numbered consecutively, and they display on the part of the author knowledge of the men, and of events connected with them, aptness of expression and facility in verse writing. Each epigram is followed by a brief notice in prose of the subject of it, indicating his more important works. This seems to have been a favourite form for short biographies, and there is something of the same kind in Paolo Giovio's "Inscrittioni." On account of the biographical details which it supplies, the *Peplus Italiæ* is still occasionally quoted. I have noticed that on such occasions the author is not called Matthæus, but Toscanus.[35]

29. With regard to his death there is a want of definite information. Tiraboschi says that he wrote the *Peplus Italiæ*, first printed at Paris in 1578, and probably died towards the end of the sixteenth century, De Angelis[36] makes the following remark: "Il mourut en France peu après l'année, 1576." If the works above mentioned, the psalms and the sacred poems, had been actually edited by Joannes Auratus, it would imply that Toscanus was dead before 1575.

But, on the other hand, the *Peplus Italiæ*, the preface to which is dated 1578, there is no reason to doubt was brought out by the author himself. It seems most correct to believe that he died in the latter part of the century. In that case he must have been a very old man, and the publication of the *Peplus Italiæ*, when, so far as one can judge, he was bordering on eighty years of age, shows that he must have been possessed of remarkable energy and vitality.

---

[35] Compare the entry by Georgii (*Allgemeines Europäisches Bücher Lexikon*, 1742, IIII. p. 225):—1578. J. M. Toscani Peplus Italiæ, seu de ejus viris doctis diss., 12. Paris, Morell. 6 gr.

[36] *Biographie Universelle*, Paris, no date, T. XLII., p. 2,

30. Nothing as yet has been said of the book of epigrams ascribed to Joannes Matthæus Toscanus by Draudius, and after him by Zedler. The book has entailed some additional confusion, but it need not detain us. The title, as given by Draudius (II. 1534), is as follows:—

Io. Matth. Toscani Anthologia epigrammatum, nunc primum edita.
Geneu. apud Petr. & Jacob. Chouet. 1619 in 8°.

The copy I have seen has a different imprint:—

1619. M. Toscani Anthologia Epigrammatum nunc primum edita.
Bvrdigalae, Apud Gilbertum Vernoy, MDCXIX. Small 12mo.

Copies of this edition are in the University Library, Cambridge, and in the Advocates' Library. There is a re-issue:—

M. Toscani Romani Anthologia Epigrammatum. Nunc primum edita.
Burdigalæ, 1620. 12°,

of which there is a copy in the British Museum (11409, a. 31), and it is also mentioned by De Angelis.

Although this collection is ascribed to Joannes Matthæus Toscanus, it cannot very well be by him. If, as stated above, Toscanus was born at the close of the fifteenth century, he was probably dead before the end of the sixteenth century, whereas the present editor must have been alive in 1619.

The book announces distinctly that it was first published in that year, and the epistle by the author is dated Kal. Jun. MDCXIX. If this be also by the author of the *Peplus*, etc., it must be assumed either, 1°, that he lived certainly to 1619, which is contrary to all probability, publishing nothing between 1578 and 1619, or, 2°, that this was a posthumous publication with the date of the preface altered to suit the date of the publication, which would be a mere assertion to support the theory of identity. Otherwise, the authors are two distinct persons.

On this point De Angelis is quite clear, asserting that they are different, and that the present person died at Condom in 1624. I have myself no doubt that they are different.[37]

But curiously enough, the fact of the editor of this anthology being called *Romanus* does not distinguish him from J. Matthæus Toscanus the poet, as De Angelis seems to imply. For if reference be made to the elegy on Turnebus (§ 22), it will be seen that the very same title is applied to its author. In fact it is the only argument in favour of the *Anthologia* having been com piled by the poet, if such a thing were not rendered improbable by actual dates. If the identity could be established, Joannes Matthæus Toscanus must have lived for 125 years or more. If he had, I fancy we should have heard of it in some other way.

---

[37] "Il ne faut pas confondre cet auteur [Jo. M. Toscanus] avec un autre *Matthieu* Toscano, Romain, qui, après avoir publié un recueil intitulé *Anthologia epigrammatum, nunc primum edita*, Bordeaux, 1620, in 8°, mourut à Condom en 1624. *Ibid.*, T. XLII., p. 2.

31. What little we know about Joannes Matthæus Lunensis is obtained from the dedicatory epistle to Geduinus prefixed by Agostino Giustiniani to the tract *De Rerum Inventoribus.* Matthæus received the name of Lunensis because he was a native of Luna in Tuscany. What Giustiniani says in his dedication about the state of the place in Matthæus' time is sufficiently striking.

> Luna, a city of Etruria, was celebrated by authors both on its own account and for its splendid harbour, but now it is remarkable only for the vastness of its ruins, out of which are dug up daily marble monuments which plainly show how great it once was. The harbour, however, which was fashioned by nature and by art, retains its magnificence to this day, having only had the name of Luna changed to that of Venus, or, as some will have it, of St. Venerius. Navigators now reckon it among the harbours which at the present time are the best; for they affirm that those of Constantinople, of New Carthage, and of Luna, or of Venus, far surpass all others.[38]
>
> In this district of Luna then, was born in our time a man called Joannes Matthæus, a learned rhetorician and especially a student of antiquity. It is he who put forth a book "De mulieribus claris"—of illustrious women—which we will shortly render accessible to all students. For in it there is besides unusual learning, a very pleasing variety of matter.
>
> He had over and above begun a book "De rerum inventoribus," which although he has left it imperfect, I am glad nevertheless, to share

---

[38] Small blame to Giustiniani for his praise of this harbour, which is better known as the Gulf of Spezia, the head quarters of the Italian fleet. It had been spoken of in similar terms by Strabo and Ptolemy, by Ennius and Silius Italicus, long before Giustiniani's[39] time, and, not to be behind any of these, the modern guidebook calls it "one of the largest, safest and most convenient in Europe."[40]

Luna, itself, however, is some distance from the Gulf, and is separated from it by a range of hills. Portus Veneris or Porto Venere, is situated on the Western promontory of the bay opposite the Isola Palmaria. The harbour of Spezia is only one of several smaller harbours of the Gulf. At the present day the fame of Luna is connected with the quarries of Carrara marble.

[39] *Ennii Fragmenta* ed. Hesselius, Amstel, 1707, p. 3 and note.

[40] Baedeker, *Handbook to Northern Italy*, 1895.

with students, so that the labours of my friend may not be altogether lost. And as the unfinished book needed a patron and guardian, you alone occurred to me, as the person to whom I should entrust the protection of the vigils of my friend most accomplished in letters and deserving well of them. For it is no secret to me how willingly and graciously you afford your patronage, most noble-minded Geduinus, to learned men. Which courtesy as you are wont to confer so readily of your own free will upon the living, you will show also to the dead; either for my sake, whom you have always loved, and for the merit of the author himself now done with life, or above all, because whatever office is performed for the dead, is esteemed not only for its humanity, but for reverence and religion, of which you have always been a zealous adherent.

Accept of this tiny booklet with the same spirit as that with which you are wont to receive all things, whether great or small, which proceed from your friends.

Farewell. Paris, April 15, 1520.

32. From this dedication we can draw six inferences.—1, That the author was dead by April 15, 1520; 2, That he wrote two books; 3, That he did not live to complete his second work; 4, That he did not himself publish either of them; 5, That they were edited by Giustiniani; 6, That the *Libellus De Rerum Inventoribus* came out before the *De Mulieribus Claris*.

33. We have no clue from this as to the date and age of the writer, but it may be conjectured that he died comparatively young, having only begun his literary labours. Assuming that he was as much as thirty years old and died shortly before 1520, he would have been born about 1490. Anyhow he must have been junior to Polydore Vergil, as he was most probably junior to his own editor, who was born in 1470. Nevertheless, he is quoted by Lessing,[41] not only because he supplied him with certain facts, but "because he is older than Polydore Vergil." I do not know on what ground Lessing could have made such a statement, for surely he must have known that Vergil's book appeared in 1499, twenty-one years before that of Matthæus.

34. The only other scrap of biography is what he himself tells us. While staying at Padua he saw a Sicilian surgeon, named Baltazar Pavonus, making an artificial nose, and helped him in his operations sometimes, to the best of his ability. This surgeon was a pupil of Branca, also a Sicilian, who invented a method of renewing ears, noses and lips, which had been lost or cut off.[42] These were

---

[41] *Kollektaneen zur Literatur*, Berlin 1790, II. p. 144.

[42] *De Rerum Inventoribus*, 1613, p. 37.

prior to Tagliacozzi, who lived between 1546 and 1599. Branca used the skin of the forehead, while Tagliacozzi used that of the arm.

35. The bibliography of the works of Joannes Matthæus, if limited, is very far from simple, and it is hardly possible to disjoin the consideration of the two books concerned. The main difficulty arises in connection with the reputed first editions of each, and incidentally as to which of them appeared first.

36. Giustiniani, who, as literary executor and editor, must certainly have known best, states clearly in his preface to the *Libellus De Rerum Inventoribus*, dated 1520, that it was this tract which was going to appear first, to be followed at an early date by the *Opus De Mulieribus Claris:* "Is ille est, qui librum edidit de mulieribus claris, quem nos propediem communem studiosis omnibus faciemus. In eo enim præter eruditionem non vulgarem, est etiam non iniucunda rerum varietas. Aggressus insuper fuerat Joannes Matthæus noster opus de rerum inventoribus, quod quamvis imperfectum reliquerit, libuit nihilo minus illud studiosis impertire, ne amici hominis labores omnino deperirent."

37. In Gesner's *Bibliotheca*, where only the treatise *De Mulieribus Claris* is mentioned, it is assigned to the year 1520: *Joannis Matthæi Lunensis opus de mulieribus claris . . . excusum Parisiis*, 1520; and then it is said to contain not only "uncommon learning, but a pleasing variety of matter:" "in eo præter eruditionem non vulgarem est etiam non iniucunda rerum varietas," which are exactly the words employed by Giustiniani.

The edition of 1520 is mentioned also by Draudius and by Teissier (supr. § 12). The title, however, as given by Draudius (I. p. 1198) runs thus: *Mulierum commendationes historicæ.*

Beckmann,[43] who is usually accurate, commits, when quoting Gesner's *Bibliotheca*, p. 394 b, the error of dating it Paris, 1523. Gesner makes no such statement.

38. With regard to this book I can find no information that shows either its scope or extent, beyond what I have just quoted.

I know of no copy; I have never seen one for sale; it is in no library catalogue which I have consulted; it is not mentioned by writers on rare books. The reference to it in Gesner *may* have been from an actual copy; but I doubt it, because the description which he adds is in the very words used by Giustiniani in the preface to the other. If this book exist, and I question whether Giustiniani ever carried his promise into effect, it must be the rarest of the rare. So far as I know there was no reissue of it at a later date.

---

[43] *Beyträge zur Geschichte der Erfindungen*, Leipzig, 1792, III. p. 559.

39. As to the *Libellus De Rerum Inventoribus*, it may have been printed in 1520; at all events that is the date of the Epistle. Of this book also I can find no copy in the catalogue of any library, or any description of it by bibliographers. It is not in the British Museum, and the author is omitted by Ebert, Brunet, and Graesse. All this is, of course, no proof of its non-existence, but it is a proof of its rarity.

40. Curiously enough Gesner makes its existence possible, although he omits it from his list, by couching his remarks about Matthæus' other tract in Giustiniani's own words.

This coincidence, which really introduces much difficulty, seems to me to be accounted for only in one of four ways:—

1°. Gesner must have copied the remark from the original MS., or a transcript thereof, of Giustiniani's preface to the tract *De Rerum Inventoribus;* or,

2°. He must have taken it from a printed copy of that preface. It could not be from the edition of 1613, and that of 1520 is the only other presumptive one. This is therefore an indirect proof of its existence; or,

3°. After having seen a copy of the 1520 edition of the *Opus De Mulieribus Claris* which he records, he contrived to express independently, the very same opinion of it as Giustiniani —its intending editor—did, and in exactly the same words as Giustiniani used about it in the preface to the *Libellus De Rerum Inventoribus*, written before the *Opus De Mulieribus Claris* had appeared! or,

4°. In the 1520 edition of the *Opus De Mulieribus Claris*, Giustiniani repeats the opinion he had already expressed about it in the preface to the previously edited *Libellus De Rerum Inventoribus* and Gesner copied it as a convenient description.

On these alternatives the following observations may be offered: The first is possible, but not very probable. The second is obviously both possible and probable, but cannot be confirmed for want of a copy. The third is conceivable only on the assump- that Gesner had not Giustiniani's remark before him. The improbability of such a coincidence occurring under the circumstances (or under any circumstances), is so great, that this alternative may be dismissed without consideration. Gesner *must* have copied the remark from some source. The fourth alternative is possible, but, for want of a copy of the books, neither can it be substantiated. It seems also less probable than the second. For, while we know that Giustiniani made the remark in 1520 in the Epistle to the *Libellus De Rerum Inventoribus*, we know nothing whatever about any edition of the other. The anomaly in the whole matter is that Gesner should quote definitely a Paris, 1520, edition of the *Opus De Mulieribus Claris*, and should describe it in terms which appear in the preface of the same date to a work presumably published sooner, which he does not quote.

All this difficulty and confusion, however, would doubtless disappear if copies of these 1520 editions could be got. In the meantime one can only draw the best conclusions possible from the very imperfect data available.

Those subsequent to Gesner who refer to the 1520 edition of the tract *De Rerum Inventoribus*, may have seen actual examples of it, but of that there is no evidence, and they may have just copied from one another.

41. If this 1520 edition ever existed it too has become hopelessly rare. It seems to have been as unprocurable in Reimmann's time, 1709. For after saying that it appeared at Paris in 1620 (which is a mistake by him for 1520) he adds: "aber anitzo allhie bey uns nicht wol zu überkommen ist."[44] Fortunately there was the reprint in 1613, and it is really the source of all we know about the author, as it contains Giustiniani's preface. This edition may now be described :—

Iohannis Matthæi | Lvnensis | Libellvs | De Rervm In- | ventoribvs | *Ex recognitione Aug. Iuſtiniani* | *Epiſcopi Nebienſis.* | M. Antonii Sabellici | De Rervm et Artivm | inventoribus Poëma. |
Hambvrgi, | In Bibliopolio Michaelis
Heringii. | *ANNO CIↃ IↃC XIII.* |

Small 8vo. Sigs. A to E in eights; or pp [2] 76, which is an error for 78, as pp. 61-62 are repeated.

(A) Title leaf.
(A 2) *r* Aug. Ivstinianvs Episcopvs Nebiensis, Roberto Gedvino, Regis Francorum à secretis, ends A 3 *r*, pp. (1)-3.
A 3 *v* Matthæus' Tract begins, and ends E 2 *r*, pp. 4-63 *(sic)*.
E 2 *r* Jacobus Wimphelingius in Epitoma German. : (description of the invention of cannon and of printing) ends E 3 *v*, pp. 63-66 *(sic)*.
E 4 *r* Sabellicus' poem begins, and ends E 8 *v*, pp. 67-76 *(sic)*.

42. Of this edition there is a copy in the British Museum (721 b. 23 (3)) and it is both in the Barberini Catalogue, Teissier's

---

[44] See § 13 and note.

list, Zedler's and Jöcher's *Lexicons*, and in Græsse's history. Draudius (I. p. 1155) quotes an edition of 1614, of which I know nothing. Reimmann gives the date 1620, but that seems to be a misprint for 1520. I have seen or heard of no edition of 1620. The edition of 1520 is referred to by Hallervord, König, Zedler, Jöcher and Græsse.

43. Pertinent to this edition there is a question which may be considered here. From what source was it taken? Was it printed from the original MS. which would be a hundred years old? If so, where had it been? How did it get to Hamburg? Where is it now? Or was it from a transcript of this MS.? Or had the printer a copy of an earlier edition—say of 1520—to work from?

To these questions the book itself gives no response, and as far as appearances go, this might quite well be the actual first printed edition. If that were so, Gesner's quotations could have been made only from a MS. as stated in the first alternative (§ 40). But if this were reprinted from an earlier copy, where is that copy now? It is wanted to clear up some of the doubts which cluster round the subject.

This may be the right place for a notice of the editor.

44. Augustino Giustiniani was born at Genoa in 1470. He received a careful education and wanted to join the friars preachers. His parents tried to turn him from this design and sent him to Valence. After a rapid course of dissipation which ended in a dangerous illness he returned home and ultimately joined the order in 1488. He devoted himself to the study of the Oriental languages, and in 1514 began a Polyglot Bible, of which the Psalter was published at Genoa in 1516.[45] In 1514 he was promoted to the see of Nebbio, in Corsica, by Leo X., which he at

---

[45] As I have a copy of this rare book and know of no description of it, the following may be useful:—

Psalterium, Hebrǫum, Grǫcū, | Arabicū, & Chaldǫū, cū tribus | latinis īterp̃tatõibus & glossis. | with corresponding titles in Hebrew, Greek, Arabic and Chaldee, printed in red and black alternately, and surrounded by a broad wood-cut border. The versions, in parallel columns, occupy both pages and run in the following order:—

On the verso: Hebrew, Latin Translation, Vulgate, Greek; on the recto opposite: Arabic, Chaldee, Latin version and notes or Scholia. At the end is a table of errata with the colophon in the five languages, the printer's mark and the Registrum.

The Latin colophon runs thus:—

Impressit miro ingenio, Petrus Paulus | Porrus, genuæ in ædibus Nicolai Iusti | niani Pauli, præsidente reipub. genuensi | pro Serenissimo Franco℞

once visited. He was present at the fifth Council of the Lateran in 1516-17.

Francis I. induced him to settle in Paris as his private chaplain and as teacher of Hebrew. He stayed there four years, and he also journeyed into Holland and England, where he was received by Henry VIII. He returned to France, then went to Genoa where he was wounded in a riot in 1522. He paid another visit to Rome, and finally in 1536, on a third voyage he perished with the ship when sailing from Genoa to Corsica. He was the author of several works of importance, especially the Annals of his native place published in 1537, a work to which allusion is made in the extract below from the *Peplus Italiæ.*[46]

Just to bring the three persons chiefly concerned in the present research into touch with one another, it may not be out of place, if I give here what Toscanus says about Giustiniani (Matthæus' editor) in the *Peplus Italiæ*, Paris, 1578, p. 65 ; or in Fabricius' edition, p. 456.

AUGUSTINUS IUSTINIANUS.
CVIII.

Historiam Ligurum prisco dum texis ab ævo,
  Gratus es in patriam Iustiniane tuam.
At Solymæ et Syræ reseras mysteria linguæ,
  Sacráque das Arabis dum monimenta notis,
Non patriam modò, non Italos, non denique solum
  Christicolum certas demeruisse genus :
Sed gelidíque Scythæ, et quos India tosta colorat,
  Acceptum referant quod tibi, munus habent.

Aug. Iustinianum Dominicani instituti Monachum edidit Genua, Hebraicæ, Syræ, Arabicæ, et Græcæ linguæ peritia clarum, quibus conscriptos sacros Hebræorum libros, additis suis non ineruditis annotationibus ex Rabbinorum fontibus derivatis publicavit : scripsit et Patriæ historiam.

45. As the present investigation is due solely to my interest in the *Libellus De Rerum Inventoribus* as connected with the bibliography of inventions, I may turn now to the consideration of that

---

Rege, prestan | ti viro Octauiano Fulgoso, anno christia | ne salutis, millesimo quingentesimo sex | todecimo mense. VIIIIbri. |

There is no pagination, but signatures : A in ten, B to Z in eights, & in eight, ℈ in six.

Apart from its rarity and from its being the first published polyglot edition of any part of the Scriptures, this book is sought after on account of the note appended to Ps. xix. referring to the author's fellow-townsman, Columbus.

[46] *Biographie Universelle*, Paris, 1856, T. xvi. pp. 605-6.

book and the place it occupies in the literature of the subject with which it deals.

The first published work in modern times on the history of inventions, was compiled by Polydore Vergil in three books, and was printed in 1499 at Venice, in a small quarto volume. It is not to be expected that either the matter or the treatment of it by him would satisfy a present-day reader. Much that Vergil says is traditional and uncritical: traditional, because the statements had been handed down from the ancients by one writer after another; uncritical, because there were no facts to contradict them, and because there was no ground to doubt the accuracy and the good faith of those who made them. Vergil did his best to give a readable and reliable narrative, one that would convey the information he had amassed to those who were curious in such questions, and cared to give his book a perusal. He had his reward. For twenty years he held undisputed possession of the field. His book was a revelation to the students of his day, who knew nothing of the subject till he had discovered it and put it systematically before them. Then they saw what they had been in need of, and were grateful. During those twenty years it passed through eighteen editions, proving that it had created a want which it alone could supply. At the end of this period the author took it once more in hand, and, adding other five books, published the completed work in a small folio volume, dated 1521.

Even when later authors had tried to marshal the old facts anew and to add what had been invented after Vergil's age, his book still remained an unrivalled authority for upwards of eighty years, and edition after edition during that time appeared. Long after this, down even into last century, its influence was acknowledged, and if we can see the gradual waning of its sway, it was not because it was ever superseded on its own lines, but because the critical method had arisen, and the subject could no longer be viewed from Vergil's standpoint. So the book of more than one hundred editions, of which three and four sometimes came yearly from the press, after serving its purpose as well as most books, ceased altogether, and has become finally a mere curiosity to be reprinted in a few copies for the members of an American book club!

46. It lies outside the scope of this paper to consider the writers on the topic, subsequent to Vergil. I have enumerated them

and their works elsewhere,[47] and it is quite enough to mention here Pastregicus, Sardus, Sabellicus who wrote a poem *De Inventoribus Rerum*, printed along with Vergil in many editions, as well as with Matthæus, Panciroli, whose book was published in 1599, a hundred years after Vergil, Almeloveen, Paschius, Michael Maier, Goguet, and so on, down to the present time, when it is necessary to bring out yearly reports in bulky volumes, so as to keep pace with the advances in scientific discovery and technical applications.

With these I do not meddle. The present enquiry is intended to make more definite the personality of Joannes Matthæus and the individuality of his work.

47. In 1520, the year preceding the publication of Vergil's completed work, may have appeared Matthæus' tract with the same title, for as has been shown, the evidence of publication is not quite conclusive. This, so far as I know, was the next attempt to deal with the history of discovery, and thus to trespass on Vergil's domain. The encroachment, indeed, was so small, that it has passed unnoticed, and except to the searcher into the nooks and corners of literature and history, both the book and the author are unknown. The omission of the author's name from recent biographical dictionaries, the rarity of his works, the defective information about him and his writings, when his name does happen to be mentioned in the older compilations abundantly attest the oblivion into which he has fallen.

Compared with Vergil's work, this *libellus*, or booklet, is not even an outline; it is merely a series of short notes. Even so, however, it enumerates a few things not included by Vergil, so that it deserves consideration.

48. The book, as one knows it in the 1613 edition, contains twenty-four chapters. They treat of the following topics:—

I. The first people.
II. The invention of letters.
III. The invention of paper.
IV. The inventors of arts.
V. The inventors of songs and tales.
VI. Inventions of the heathen gods.
VII. Inventions of kings and chiefs.
VIII. Inventions of philosophers.

---

[47] "Notes on Histories of Inventions and Books of Secrets," 1882-1898 in the *Transactions of the Archæological Society*, Glasgow.

IX. Inventions of poets.
X. Inventions of different nations.
XI. Inventors of ships and their belongings.
XII. Inventions of Christians.
XIII. Inventors of implements of war.
XIV. Inventors of metals, various arts, fabrics and tools.
XV. Inventors of musical instruments.
XVI. Inventions of painters.
XVII. Medicines discovered by animals.
XVIII. Inventors of the uses of plants.
XIX. Discovery of certain fruits.
XX. The use of animals.
XXI. Inventors of games.
XXII. Inventors of crimes and punishments.
XXIII. Inventors of foods.
XXIV. Inventions and ordinances first made at Rome.

These, which are probably the author's own divisions of the subject, are followed in the 1613 edition by two paragraphs on the discovery of fire-arms and of printing respectively, taken from the *Epitome Germanicarum Rerum*, by Wimpheling.

49. The accounts given are the briefest possible, seldom going beyond two or three lines, and they are mere headings, or texts that could be, and in some cases have been, amplified by others. One merit that Matthæus has is that he adds the authorities for most of his statements. They are not what we should call critical or reliable at the present day, but they were all that could be had four hundred years ago. A list of them may be given, partly to show who were considered good authorities, partly to illustrate the nature and extent of Matthæus' research. They may be arranged alphabetically for convenience :—

Acron.
Aquinas.
Aristotle.
Ausonius.
Bracelleus.
Callimachus.
Capella.
Cicero.
Columella.
Cyprianus.
Diodorus Siculus.
Diogenes Laertius.
Donatus.
Eusebius.
Festus.
Florus.
Gellius.
Heraclides Ponticus.
Herodotus.
Hieronymus.
Horatius.
Hyginus.
Josephus.
Justinus.
Juvenalis.
Lactantius.
Lampridius.
Livius.
Lucanus.
Macrobius.
Martialis.
Mela.
Ovidius.
Plato.
Plinius.
Politianus.
Priscianus.
Plutarchus.
Quintilianus.
Seneca.
Servius.
Strabo.
Tacitus.
Theophrastus.
Valerius Maximus.
Varro.
Vegetius.
Virgilius.

50. Consideration of these authorities will give one a fair notion of the information Matthæus had. As they, with one or two exceptions, are Greek and Latin, obviously he could do no more than repeat what he finds in them. As they in turn, and the Greeks more particularly, ignored other nations, and, founding on their own traditions, claimed as far as might be all inventions for themselves, any approach to a reasonable insight into antiquity, as would be demanded now, is not to be looked for; in fact it could not have existed, and the various statements must be judged of with this proviso.

In these authorities there is no idea of the growth or development of an art or science from small beginnings till it reaches a fully developed state, but to some definite personage, or it may be vaguely or comprehensively to certain tribes or nations, various inventions are said to be due. The course of events was in this wise: nothing of a given kind existed until a certain person appeared, the inventions followed, and forthwith it was adopted generally. There are claims for inventions on behalf of this or that deity or hero, king or warrior, priest or philosopher, statesman or poet, which, in so far as the personage is mythical or symbolical, could be hardly substantiated as matter of fact. The first discovery, whatever it was, must be looked for in a different way.

On the other hand there are inventions, or modifications of those already known, which might be quite well due to individuals, and even to those mentioned. That is a question of evidence.

51. When Matthæus comes nearer to his own time and gets out of the range of classical influence, he refers to some novelties in such a way as to make us regret he had not included more of them, and left the poetical and legendary discoveries of Pliny, Ovid, and others for the edification of the schoolboy, instead of recording them as authentic and worthy of consideration as historical facts.

That grammar, for example, logic, rhetoric, music, ethics, and so forth were invented by specified individuals, usually of Greek nationality, shows how rudimentary the motions were with which Matthæus had to be content. Even in certain instances there was a want of agreement, as when it was stated that the hexameter was first used by Ennius, or by Moses; or that Solomon wrote the first Epithalamium, though elsewhere Apollo is named as the author of the first nuptial song, on the occasion of the marriage of Peleus and Thetis.

The invention of medicine, again, is ascribed to half-a-dozen different persons.

Joseph was the first interpreter of dreams.

Sardanapalus was the first to make a bed of feathers.

Endymion was the first to understand the nature of the moon; Parmenides to show the identity of the evening and morning star.

Cæsar first ordained that the daily acts of the senate and people should be drawn up and published.

Sergius Orata first invented oyster ponds, and gave the pre-eminence to the Lucrine oyster for flavour.

Neptune was the first breaker-in of horses and taught the art of riding.

Publius Malleolus (good name) having killed his mother, was the first to be sewn in a leather bag and thrown into the sea. Some other ingenious tortures are described.

The Cyclopes were the first builders of towers, says Aristotle, but Theophrastus, the Phœnicians.

These, taken at random, and many similar statements, are not all of like character, do not rest on similar evidence, and are not of the same degree of probability.

52. Even in the works of the ancients themselves, as of Pliny, whose very words Matthæus transfers to his pages, one must distinguish between what they repeated as legends and what they knew as matters of fact, possibly because they fell out during their own life time. There is not much of a difference perhaps between the statements that a reed pipe was made by Pan and that purple was used for the toga prætexta by Tullus Hostilius, but it is more reasonable to believe that M. Agrippa was the first to receive a naval crown, than that Pluto invented navigation and was made admiral of a fleet by Saturn. It is more credible that Caius Gracchus first put up milestones, and "louping-on stanes" [48] than that a snake, after hibernating, restores its sight by rubbing itself with fennel, or if scales have grown over its eyes picks them off with juniper spines. A person of the name of Mercury may have invented the lyre, but there is much stronger evidence that another person, Pompeius Magnus, was the first to complete the building of a permanent theatre of hewn stone in Rome.

But to begin to review the contents of this booklet would be to undertake not a criticism of Matthæus—for after all he only copied what he read—but a criticism of his authorities; in short to compile a treatise on Antiquities. To what extent that would run at the present day it would be hard to say, no one person could survey it all; the field is so vast, and the knowledge, imperfect though it be still, is so specialised. Anyone, however, who has the curiosity to see what could be said on the subject by one person, a century ago, can refer to Rollin or to Goguet.

---

[48] Lessing (*Kollektaneen*, Berlin, 1790, II. p. 149), says he does not know the authority for this. His editor shows that it is Plutarch.

53. It may not be out of place, however, to refer very briefly to the inventions which were post-classical and in certain cases contemporaneous with Matthæus himself. These, indeed, merit special attention for, according to Lessing, they seem to have been chronicled by Matthæus for the first time. They occur in chapter xii., and are the following:—

Albertus Magnus invented fire arms and artillery.[49] Branca, a Catanian, introduced the method of restoring noses, lips and ears. His pupil was Baltazar Pavonus, a Sicilian, who practised this art at Padua, and Matthæus when there, assisted him, as has been said above (§ 34).

To a woman named Saint Cita, of Lucca, he ascribes the invention of putting gold on leather, so as to make what were called *auripelles;* for which her festival is observed annually with the greatest honour. This leather was used for wall decoration and for covering chairs.[50]

He refers to a modification of this art, in which plates of silver were fastened on skins and then coloured yellow to resemble gold. These were also called *auripelles*, and the invention, a new one, was claimed by the Messenians.

Michael Scotus the famous astrologer, invented an iron skull-cap. He alludes to this also in cap. xiii., p. 44 under the inventors of arms. Lessing[51] is much puzzled as to what this *galea ferrea* could have been or for what purpose. It was also called *cervilerium,* and Michael contrived and wore it so as to ward off the fate which he had forseen was to befall him. The legend is that he knew he should be killed by the fall of a stone upon his head, so as a protection he wore this head guard. But in vain. For being in church and uncovering at the mass, a small stone fell from the roof and striking his head caused his death. The legend seems therefore to have been known when the iron cap is mentioned as a discovery of Michael's.

---

[49] Naudé (*Apologie pour tous les grands Personnages . . . soupçonnez de Magie*, Paris, 1625, p. 518), quotes this statement as opposed to current opinion, from "Iean Mathieu de Luna, *Lib. de rerum inventorib. cap.* 12, *f.* 10," one of the few references to our author I have fallen in with. Unfortunately, Naudé has omitted the date of the edition he used, and I do not know precisely what he meant by "*f.* 10." It is natural to suppose that the 1613 edition, not long published, would be in his possession. But if "*f.* 10" mean "*folio* 10," it does not apply to the 1613 edition, in which the reference to Albertus is on p. 37, and that to Wimphelingius is on p. 64. Can Naudé have been referring to the 1520 edition, or to a MS. ?

[50] Lessing, *Kollektaneen*, Berlin, 1790, I. p. 94. He refers to Cardan *De Rer. Var.* lib. XIII. c. 56. [Imitations of this "Venetian" leather have been introduced within the last dozen or twenty years. May, 1900].

A timepiece with a striking arrangement was a Christian invention, like that of *bells,* which were first cast at Nola, in Campania. The ancients had only water and solar timekeepers.

Stirrups, which are not seen on Roman statues, flails, and the rest in which the lance was put, are all modern inventions.

Water mills are modern, but wind mills are much more recent. The ancients had only hand mills and mills driven by asses.

Angelus Barroellus, a Venetian, made colours and pictures of glass and crystal. As Lessing points out (*u. supr.* I. p. 213), this can apply only to the revival of an art in which the ancients were skilful.

The use of the magnetic needle is modern. It is curious that while aware of its importance for navigation he should have made no reference to contemporary geographical discovery, though he was living in the very midst of it, and Luna is not far from Genoa.

Printing was found out in Germany "after the Christian era," Prior to that Saturnus taught the Italians to print letters, as Cyprian narrates in his book *De idolis,* and Matthæus alludes to the same thing in cap. II.

Wooden platters on which to cut meat were first devised in the days of Frederick, the Roman King, and of Pope Gregory, who also placed the divine Dominic, ounder of the order of preachers, among the saints.

Not long after arose the Flagellants, who went about in pairs or in bands and scourged each other with whips. They were founded by a Cardinal, Jacobus Columna.

At this same time, by divine judgment, it was caused that all the French in Sicily, religious and secular, perished "una die, unaque voce Dei." In such reticent terms Matthæus refers to the *Sicilian Vespers.*

---

[51] Lessing, *Kollektaneen,* Berlin, 1790, II. p. 351.

At this time, also in Sicily, was the fish-man, Nicolaus, a Messenian, who lived in the sea, and revealed many of its secrets to men. "He chose this inhuman mode of life after being cursed by his mother." He was quite a well-known personage, and is noticed by Lessing (II. p. 193).

The fabricating of paper, sails, and clothes from cotton is a a recent discovery.

A ball full of air for playing with, which might be called an "air-ball," is a recent invention, although we read that boys of old played with a "follis" or leather skin full of wind; but that (he thinks) was different, for modern "air balls" were devised by Marchio of Ferrara. But it is difficult to see in what the difference consists.

Tallow candles were first made in Ferrara. They were unknown to the ancients.

The training of birds for hunting, such as different kinds of owls, is a Christian invention; for the ancients used dogs for bird catching.

The making of spectacles, or eye-glasses, from glass, or crystal, or beryl, Matthæus thinks, is an ancient rather than a modern discovery.

A spear-shaft drilled longitudinally, through which little clay pellets sufficient to kill birds, could be shot by blowing, is a recent discovery. He begs pardon of the learned for proposing to call it *tuba aucupatoria* on the analogy of *area aucupatoria*, *pertica aucupatoria*, *calami aucupatorii*, *rete aucupatorium*. We could translate it "fowling-tube," having already fowling-piece. It is analogous to the "blow-pipe" for shooting darts employed by the Indians of the Amazon. There is a note by Lessing on the Italian name, *Ciarbottana*, of this contrivance, in the *Kollekanteen*, I. p. 119.

These observations have so far the merit of originality, and in that respect differ from the rest of the book. In the very general terms, too, employed, Matthæus unconsciously recognises the difficulty of assigning an invention to its author, and this, too, is in marked contrast to the rest of the book.

54. In attempting to estimate Matthæus' work fairly and to do him justice, certain considerations have to be borne in mind.

a. The time at which it was composed, when there was no possibility of systematic enquiry into the subject of invention and discovery, and when every statement was based for want of better upon mere authority, classical or other. It may be questioned if anyone, compiling a book of origins at the present day, would not, in many instances at least, give expression to opinions as vague, contradictory, and controvertible, as anything to be found in Matthæus.

b. As Giustiniani warns us this is not a complete or finished work, but only the author's first notes, put down very briefly under their respective heads, sometimes with the names of the authorities, sometimes without them, but often in the latter case easily traceable.

c. The apparent ascription of the same inventions to several persons may be due solely to the unfinished condition of the work. Matthæus, very properly, took note of everything he found, and he may have meant to discuss, subsequently, the authority for the various statements and decide in accordance with the evidence. From variety of recorded opinion it must not be inferred that Matthæus had drawn no definite conclusions, or was incapable of doing so.

d. Although, in most instances, the statements are mere memoranda, yet to have obtained even these displays an amount of research, of examination, and of knowledge of what had been written on the subject, both professedly and incidentally by Greek and Latin authors, which reflects credit upon Matthæus. I think one is quite entitled to be grateful to Giustiniani for not allowing the work to perish.

55. The question may be fairly asked to what extent—if any—may Matthæus have been indebted to earlier writers on the same topic. One can hardly judge of this little pamphlet without comparing it with those which preceded it, and singularly enough all the early histories which I know are by Italians, and they cover so nearly the same ground that it is difficult not to believe that one took the idea from another.

The earliest writer was Pastregicus whose work *De Originibus Rerum*, though not printed till 1547, was written in the first half of the fourteenth century. Matthæus may have seen this in MS., and may have used it, but there is no evidence on the point. There is a great difference in the arrangement of the two, for while the order in the older work is alphabetical by the names of the inventors, that in Matthæus' is by groups of inventions, as can be seen by the index of chapters. But in both cases we are furnished with mere notes and authorities.

The next is Zacharias Lilius who published a volume in 1496 at Vicenza, which includes the history of the Arts. He confines himself, however, to the seven liberal arts, the *trivium* and *quadrivium* and their adjuncts, and says nothing about practical inventions. Even supposing Matthæus had been guided by Lilius in the former section, he must have gathered his details respecting the practical arts from other sources.

Polydore Vergil's book followed in 1499, and making every allowance for its more elaborate character there is sufficient resemblance between these two books of all but identical title, to make one think that Matthæus may have had Vergil's work beside him when he was drawing up his own tract.

Both Vergil and Matthæus, although it does not appear obtrusively, follow to a certain extent the trivium and quadrivium, and there is hardly anything in Matthæus which could not be found in Vergil, often in nearly the same words. But that by no means implies direct copying on Matthæus' part, but really the use of the same authorities. Such repetition is common to all the historians referred to above, so that it is not possible to attach importance to it. Whether Matthæus copied not only the words but the references as well, so as to make it appear a reference of his own is a question which could be discussed, if it were necessary.

56. The remarks now made may be sufficient to give a notion of the scope of this "libellus," all that remains of its author's labour and learning. What may have been his ultimate design, one can hardly conjecture. Perhaps, like Gregory Reisch, his contemporary, he had simply made notes for his own use without any intention of printing them, and his name might have passed into absolute oblivion. Thanks to Giustiniani he has been rescued from forgetfulness, and the tiny vessel which has successfully floated his name down to us after its perilous voyage across four centuries, has been seen and "spoken with" by others at intervals of fifty or a hundred years.

Michael Heringius who printed or re-printed the book in 1613, Almeloveen[52] who in 1684 reported it as a history *ex professo*, Lessing who in 1790 used it as an authority, Beckmann who in 1792 included it in his list of histories of inventions, and a few more, some with clear observation, others confusedly, have all helped to give Matthæus his place. After the lapse of another century, during which time the frail craft had passed completely out of sight, it has come once more to land and I hope the attempt to recognise its character and identify its owner has not been unsuccessful.

---

[52] *Rerum Inventorum Onomasticon*, Amstelædami, 1684, Epistle, A_2 *verso*.

57. After what has been said it is not difficult to understand how confusion between the two men has arisen :—the similarity of the name ; the supposition that Lunensis and Toscanus were place epithets, and were practically the same, because Luna is in Tuscany ; their both belonging to the same century ; their works being nominally edited by others ; a certain analogy between their subjects, for while Matthæus Lunensis wrote about distinguished women, Toscanus in his *Peplus* recites the achievements of notable Italian men. But though the mistake of identification may be palliated by such explanations or excuses as the preceding, any of the following equally patent considerations should have been sufficient to raise a doubt at least as to identity being possible or even probable.

a. There is an interval of nearly fifty years between the two sets of publications.

Giustiniani, in 1520, speaks of Lunensis as dead, and having left his historical notes behind him. One can conceive it possible that the Latin poems might have lain in manuscript till Dorat discovered and published them. But that is untenable, for Toscanus was a personal friend of Dorat's, and his poem on Turnebus was written and published in 1565. Moreover in the *Peplus*, first published in 1578, Toscanus has the above-quoted laudatory poem on Giustiniani, who was drowned in 1536, and this fact alone is quite enough to show that Matthæus and Toscanus are different. The obituary runs thus: Matthæus died before 1520, Giustiniani in 1536, Toscanus after 1578 (?) Dorat in 1588.

b. There is no reference—as, indeed, how could there be ?—by Giustiniani to writings by Matthæus except the two already specified, and on the other hand there is no allusion to either of the earlier works in those connected with Toscanus. For the identification, therefore, by Hallervord, and later by Zedler and others, there is no support in the works themselves, or in any observation of their respective editors.

c. Lunensis is an epithet from Matthæus' birthplace. Toscanus, whatever it may have meant originally, is a family name, and has nothing to do with the birthplace of the person.

d. While certain authorities have confused the two, others have distinguished them with more or less precision.

It is certain now to my mind that the two writers were different persons. I myself following my guides without sufficient examination repeated their mistake. I am glad of this opportunity to state what is really the correct view of the matter, and to amend my former account.

XI.—*The Assyrians in the Judith.*

By DAVID H. CRAWFORD, M.A.

[Read before the Historical and Philological Section, 17th March, 1902.]

THE title chosen for this paper was not intended to be comprehensive, but only to indicate the point at which I definitely break away from generally accepted views, and proceed to offer some original suggestions.

The *Judith* is contained in the same MS. as the *Beowulf*, the famous Cotton Vitellius A XV. Unfortunately, what is preserved is only about a fourth part of the entire poem—only 350 lines, making up 14 lines (13½) of Canto IX. and the whole of the three last cantos. No doubt this is the finest part—the triumphant close of the poem: but, unquestionably, with the whole poem to work on, scholars would have been better able to come to a sure conclusion regarding its date, its authorship, and the original dialect in which it was composed. As it is, its author is quite unknown, its date and place of composition are still uncertain, in spite of the assumptions of various scholars.

The fragment opens with a banquet, given by Holofernes, the Assyrian leader, to his chiefs, when Holofernes "drinks much more wine than he had drunk at any time, in one day, since he was born." Then Judith to avenge wrongs to her country, and meditated wrong to herself, cuts off Holofernes' head, in his tent; shows it to the Hebrews as a token of victory, and urges them to sally forth at daybreak and attack the Assyrians. They do this and put their enemies to rout or to the sword.

The subject matter is largely taken from the Vulgate version of the Apocryphal Book of Judith. The poet, however, uses remarkable freedom, and shows an independent and creative instinct. He borrows, like all true poets, in a princely fashion: the matter is ennobled and irradiated by his genius.

This is to be borne in mind; for his manner of borrowing, his use of the material before him, should affect our ultimate view of the poem. The poet, then, transposes some incidents, selects and rejects others, amplifies and expands to suit the purpose of his own composition. When Sweet remarks that "in constructive skill the unknown author surpasses both Caedmon and Cynewulf," he says a great deal, but he says, what I think, is perfectly true; but he adds, "and in perfect command of his foreign subject," a statement, the truth of which is open to the gravest doubt. The fact is, the poet's constructive skill reaches such a high degree of perfection, simply because it is not hampered over much by a foreign subject. The poet does not allow himself to be so hampered.

Turner, in his "History of the Anglo-Saxons," comes nearer the truth in his estimate: "The fragment may be deemed another Anglo-Saxon poetical romance. (Mr Sweet, to be consistent, would call it a Hebrew Romance.) The subject is taken from the Apocrypha, but the Anglo-Saxon poet has borrowed merely the outline of the story. All the circumstances, the descriptions and the speeches which he has inserted, are of his own invention. He has, therefore, done what all the Romancers did. He has applied the manners and characters of his day, to the time of Judith, thus really making it an Anglo-Saxon Romance."

How, then, may we settle the place of the poem in our early literature? One scholar remarks that it clearly belongs to the culminating point of the Old Northumbrian literature, since it combines the highest dramatic and constructive power with the utmost brilliance of language and metre. In agreement with this, Stephens, Hammerich, and Ebert place it about the close of the 7th century (700), Kluge and others, so late as the opening of the 11th century.

We get something more definite, in an interesting theory, propounded by Professor Cook, of Yale. He puts the date about 856, and assigns the poem a West-Saxon origin; supposing it written in honour of King Alfred's step-mother, whose name was *Judith.* A mere girl of twelve or thirteen, she had been married to Aethelwulf, Alfred's father, to seal a warlike alliance with the Frankish King, the young girl's father. This pleasing theory is, however, quite inconsistent with the argument from metre, language, and style. A thorough investigation of these proves that the original must have been in an *Anglian* dialect, and that the author stands nearer the school of Cynewulf than that of Caedmon. In line 155, *e.g.* gecythed uncontracted = gecydd, is *Anglian*; also line 197 hafath = haefth is *Anglian.* These uncontracted forms are necessary for the metre, and so were retained by the W. Saxon scribe, for the metre's sake. The language and style, too, show great similarity to those of the undisputed poems of Cynewulf.

Furthermore, I think the intense seriousness of the poem, in itself, is fatal to the theory, and it would have seemed ridiculous to suggest a comparison between the heroic figure of Judith in the poem, and Aethelwulf's girlish queen.

This brings me now to deal more particularly with the internal evidence. Most critics of the poem give a one-sided and partial account. One says it breathes only of triumph and warlike enthusiasm, another speaks only of its religious warmth. The two are really combined, and inseparably connected. Hammerich is nearer the truth, when he says, "It proves that the Christian poets took special delight in the glories of the strife and manly virtue."

The strife, then, is between the Assyrians and the Hebrews. The Assyrians are pagans or heathen; the Hebrews are transformed into Christians, and Judith their champion, who, in the Apocryphal Book is a rich Jewish widow, becomes a wise and radiant virgin. By a glaring anachronism, she invokes the aid of the Trinity in striking off the head of Holofernes.

The poem, then, describes a struggle between heathens and Christians, and the victory of the latter. But consider the spirit which animates this description. No intelligent reader can escape being impressed by the feeling of deadly earnest and intense hatred which inspires the poem. Again and again throughout the poem, the Assyrians are spoken of as the hated, the detested race; in line 323, they are "those whom they hated most of living races." A further point is reached, when we note the epithets applied to both peoples. The Hebrews are londbuende = dwellers in the land, the native inhabitants, also ethelweardas = warders of their native land; the Assyrians are eltheode = stranger folk, invaders. The Assyrian army is usually called *se here* the harrying host; and this brings us to the almost certain conclusion that the Danes are in the poet's mind, *se here* being the phrase constantly applied by the Chroniclers to the invading Danes and Northmen.

The great struggle between the English and the Danes, lasting roughly from 800-900, was of vital importance to the nation. The very existence of the Anglo-Saxon element depended on the outcome of it. It was a life and death struggle, and the history of the period is simply engrossed by it. Moreover, it was a struggle between paganism and Christianity, and was recognised as such by all contemporary writers. Bishops marched regularly in the English armies, often perishing on the battle-field. There were four bishops with Althelstan at the great battle of Brunanburh, 937. The Church was naturally up in arms: for, apart from the general misery and devastation, the Danes plundered and destroyed the monasteries, put the holy brethren to the sword, trampled beneath their feet the sacred relics and precious treasures of the Church. So, nearly all the great men of England, in those days, were men of faith who trusted in the sword.

But if our poem reflects the spirit of its time, it could not have been composed while the Danes were winning. The exultation of victory rings through it, and we must find a period of history which justifies this. Could the poem have been composed in Northumbria? Manifestly not, for there the forces of Christianity were prostrated and helpless under the foreign terror. The disasters began in Æthelred's reign 790-796 and the foreigners had conquered Northumbria by 870. Besides, it was impossible for literature to flourish amid continual feuds and constant disturbance, not to speak of the supremacy being in the hands of the foreigners.

Let us look at the poem again. In l. 228 the Assyrians are called "old enemies—eald genithlan;" we hear of ancient quarrels, and old grudges—"fyrngeflitu, ealde aefthoncan," ll. 264-5, *cf.* also, ealdfeondum—316; ealdhettende—321.

Assume that the poet was thinking of the Danes, and you must infer from these descriptive epithets that *the quarrel was of long standing*, and that now the tide of war was turned—the Christians were winning.

What period of Old-English history does this suit? Clearly not the time of Alfred the Great; he nobly held his own with the heathen, but he left the work of conquest to his children; it was his great son Edward who actually turned the tide of war, assisted by his sister Ethelfleda and her husband Ethelred.

I pointed out that the evidence of language suggests an Anglian origin. Northumbria we have already ruled out of court, seeing literature "cannot blossom where peace and security are not." But a Mercian origin is still possible; and history unquestionably supports a Mercian origin. Mercia was the seat of great military operations. It was in the Midlands in the days of Edward that the great victories were won against the heathen invaders; the whole of Mercia was gradually recovered from their rule in the years between 905-922.

Here I will introduce to you a great and heroic figure, Aethelflaed, the daughter of Alfred the Great. She played the chief part in the campaign against the Danes in Mercia and to the North. She built a long line of fortresses to curb them. Some old forts she restored, Chester for example, others she built in suitable situations and filled with soldiers to protect the natives and repel the enemy. One main object was to cut off the Danes in the North from the Welsh, and to prevent their securing reinforcements from their kinsmen in Ireland, through the Severn, Dee, and Mersey.

The latest editor of the Saxon Chronicles refers to confused but interesting notices of her conflicts with the Danes, in "Three Fragments of Irish Annals," ed., O'Donovan for the Irish Archæological and Celtic Society, but I have not seen these accounts.

The Chronicles themselves bear testimony to the greatness of Ethelflaed. Her heroism evidently caught strong hold of the Old English imagination. The first mention of her by name is found opposite the year 910, though she had previously, with her husband Ethelred, restored Chester in 907. Her figure is clearly outlined in the Chronicles, a magnificent pattern of a warrior-queen by the side of her brother Edward. The old chroniclers, not so dry-as-dust after all, clearly were attracted by this woman and felt her greatness. William of Malmesbury calls her "favor civium, pavor hostium,"—the darling of her people, the terror of her enemies.

There had been another Ethelflaed of Northumbria, daughter of the famous king, Oswy. When this Christian king triumphed over the heathen Penda, Ethelflaed as a sort of thankoffering had taken the religious vows. But the Mercian Ethelflaed, Alfred's daughter, lived out her life in the world. Henry of Huntingdon remarks that her power was said to be so great, that some called her not only *domina* or *regina*, but even *rex*. The collected evidence of Freeman and Green goes to show, that though Edward, her brother, was king and overlord of all England not then under Danish power, yet she with her husband Ethelred, occupied a semi-regal position not much inferior to

Edward's own. They are together called *lords of the Mercians*, and the favourite title of the Latin Chroniclers given to her alone, (her husband died in 911,) is *domina Merciorum;* hence she is perhaps best known in English history as "Lady of the Mercians."

At the court of Ethelflaed, her nephew Athelstan was brought up. He took up the Danish struggle after his aunt's death, no doubt inspired to emulation by her heroic deeds. In 937 he won the battle of Brunanburh against the Danes and Scots combined.

My theory, then, is that the heroism and success of Ethelflaed inspired the *Judith.* She is the only woman, who in Old English history attains heroic proportions during the national struggle. I do not suppose that she ever struck off a Danish leader's head; we should not look for such extreme similarity or rather identity in the incidents. But every true and great poet is the child of his own time, as well as a "nursling of immortality." The *Judith* could only have one reference to an English audience or an English reader, if the Danes had already come; if we are to believe it was written before they came, the passionate earnestness and the religious enthusiasm could have met with little response in English hearts.

XII.—*The Potential Difference necessary for a Double Spark Gap.*

By H. STANLEY ALLEN, M.A., B.Sc.

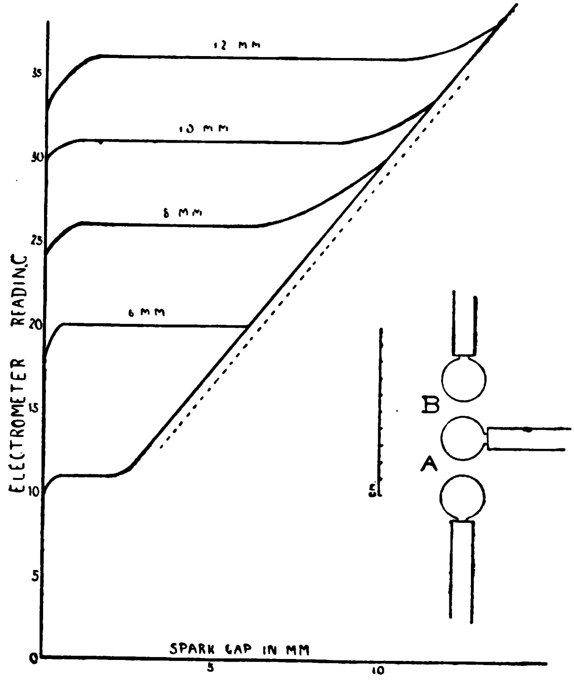
[Read before the Mathematical and Physical Section, 23rd April, 1902.]

IN the course of some experiments with sparks from a large condenser, it was noticed that the potential difference between the plates of the condenser required for a discharge to pass across two gaps in series was not much greater than the potential difference necessary for a single gap. The experiments to be described were undertaken in order to obtain more exact information as to the potential required, and if possible as to the manner in which the two sparks are produced.

In dealing with a double spark gap it is clear that there must be a portion of the circuit between the two gaps, which at the outset is entirely insulated, having no direct electrical communication with either plate of the condenser. Experiment showed that the form and disposition of this portion of the circuit, which may be termed the intermediate conductor, exercised a considerable influence on the potential difference. In order to make the circumstances as simple as possible, this conductor consisted of a brass sphere screwed into a brass socket attached to an insulated support. The two other terminals were spheres of the same size and material. (The two spark gaps are shown drawn to scale in Fig. 1.) The central sphere was fixed, but the other two could be moved in a vertical line. The upper terminal was attached to a micrometer screw of half millimetre pitch, giving a fine adjustment, while the lower terminal was supported on a stand whose height could be adjusted.

The large Wimshurst machine belonging to the Blythswood Laboratory provided a convenient source of electricity. It was used to charge four large Leyden jars, the capacity of each being approximately the two hundred and fortieth part of a microfarad. Certain sets of observations were repeated with double the number of jars, but without any appreciable influence on the result.

The potential between the opposite surfaces of the jars was measured by means of a Kelvin electrostatic voltmeter, capable of reading from 10,000 to 50,000 volts, each division of the scale corresponding approximately to a thousand volts. With the capacity employed, the needle of the instrument rose steadily to the potential at which the discharge took place, so that it was possible to read correctly to half a division of the scale. The case of the electrometer and the outside of the jars (in connection with the upper terminal) were put to earth. In taking a series of observations, the lower gap A was adjusted to some definite distance, and the length of the second spark gap B, increased by half a millimetre after each observation. Each observation comprised the measurement of the spark length together with two readings of the electrometer.



The results of these observations are best shown by curves giving the relation between the potential difference and the spark length. If we consider such a curve for any assigned value of the gap A (say 8 mm.), we find that it consists of three distinct parts. Starting with the upper spheres in contact and gradually increasing the gap B, the potential difference also increases, but at a rapidly diminishing rate, until a point is reached at which the potential difference assumes a constant value as the gap increases. This stage persists until the gap B is nearly as great as the gap A, when the potential difference again begins to increase, and rapidly assumes a constant rate of increase, so that the curve becomes a straight line, inclined to the axes of co-ordinates. The same stages occur when other values are given to the spark gap A, and it was found that the straight line representing the final stage was practically the same for all values of A. As considerable intervals of time separated some of these observations with different values of A, a further series of observations was made, in which B was kept constant and A varied. The result just mentioned was confirmed, when the gap B is greater than the gap A the potential difference required depends only on the value of the longer gap.

In fact, these further observations showed, as might have been anticipated, that the relative position of the two gaps made no alteration in the value of the potential difference.

For the sake of comparison, a series of observations was taken with a single gap, and the resulting curve was found to be a straight line, in agreement with the experiments of previous observers. (J. J. Thomson, *Recent Researches*, p. 74.) Moreover, this straight line was found to be parallel to the straight line obtained with a double gap, and to run only a short distance below it.

The whole of the results may be summarised by saying that *the potential difference required to produce a spark across a double gap depends almost entirely on the longer of the two gaps, exceeding by a small amount that which would be required for the longer gap alone.*

Some explanation of these results is afforded by a fact that was noticed during the course of the observations. When the spark gap B is made longer than the gap A, very fine thread-like sparks begin to cross the smaller gap before the passage of the main discharge. As the gap B is increased the number of these fine sparks becomes greater, and when B is very much greater than A they continue for quite a long time before the potential rises high enough to cross the longer gap. In fact the B gap may be made so great that the potential never does get high enough, for the particular speed at which the Wimshurst machine is running, and then there is a constant stream of the little sparks at A, but the main discharge never takes place.

It is well known that the discharge of a condenser is in general of an oscillatory character, but if the resistance of the circuit be sufficiently increased the discharge becomes non-oscillatory. If a spark gap is included in the circuit, the sparks produced are excessively feeble and give very little light, though there is a somewhat brighter glow in the neighbourhood of one of the two electrodes. The fine sparks referred to above appear to be of this nature as they exactly resemble the sparks produced by inserting a high liquid resistance in the discharge circuit.

According to Professor Schuster the ordinary spark discharge of a condenser is preceded by one or more fine thread-like sparks which are visible in photographs of the discharge.

"Some sharp linear luminous filaments may be seen in the original (photograph) on one side of the main discharge. These set out from small projections on the electrodes and precede the main discharge, as may be ascertained by carefully watching the image on the focussing plate of the camera. The preliminary discharges may be avoided by giving careful attention to the polish of the electrodes." (*Phil. Trans.*, 193, 1899.)

Whether the sparks observed by me are similar in character to those described by Professor Schuster or not it seems clear that they practically abolish the resistance of the shorter spark gap, probably by giving rise to a supply of free ions, and so reduce the potential difference to little more than that required for the longer gap.

In conclusion, I must express my sincere thanks to Lord Blythswood, to whom the inception of these experiments was due.

XIII.—*Editions and MSS. of Wyntoun's "Cronykil."* By F. J. AMOURS, B.A., vice-president of the Historical and Philological Section.

[Read before the Historical and Philological Section, 17th Feb., 1902.]

ANYONE seeking information about Andrew Wyntoun in the "Dictionary of National Biography" will be surprised at the scanty list of authorities to be consulted concerning the life and works of the Scottish chronicler. It consists of four items: the two editions of the Chronicle, and two review articles by Mr W. A. Craigie. This is not very creditable to the patriotism of the Scot, who is so fond of his vernacular mediæval literature, and rightly, too, for Scotland can boast of two historians (I am using the term in a broad sense)—Barbour and Wyntoun—who, for individuality, sturdy love of their native land, and raciness of the soil, stand above the English chroniclers of about the same age, such as Robert of Gloucester and Robert de Brunne.

Wyntoun, indeed, has not been neglected as a recorder of facts; the historical student has gleaned pretty exhaustively through his chronological records, but he has been satisfied with the text before him, and has never gone behind it, nor inquired whether the numerous MSS. have been examined sufficiently to enable us to say that we have the right Wyntoun and the entire Wyntoun. There is one very plausible excuse for this self-satisfied acceptance of the Chronicle as it has been printed for us. It contains about thirty thousand lines, and is found in at least nine MSS.; so it is no light task to compare and check all those texts; it is easier to trust to the print, and take it for granted that the editor had nothing more to give than what he has given.

Now, I must state at once that Wyntoun has not been well-used by his editors, and the aim of these remarks is to show, by a short description of the two editions and of the nine principal manuscripts, that there is room for a third edition which will give all the material needed for the working out of the many problems with which the Chronicle bristles. It is impossible, with our present printed text, to discover what Wyntoun wrote first, what he changed afterwards, how often he altered his work, how much he owes to others, how the different texts are connected with one another, and so on. Surely the Prior of Saint Serf deserves as much from his native land.

The Original Chronicle was published, for the first time, in London, in 1795, by David Macpherson. It fills two handsome volumes that are seldom met with now, as only 275 copies were printed, at the editor's own cost, 26 of which were still in his hands when he died twenty years later, which proves that antiquarian literature did not pay then any better than now. As Macpherson lived in London, he had only access to the manuscripts in the British Museum. They were three in number —the Royal, the Cottonian, and the Harleian. The first two are the best we have of the Chronicle. He knew of the two manuscripts in the Advocates' Library, and obtained a few readings from them through a friend, but they leave hardly a trace in his notes. He adopted the Royal for his text, backing his own judgment with the opinion of Father Innes who, at the beginning of the century, had been the first to study the MSS. of Wyntoun.

As is well known, the Original Chronicle is so called, not according to the obvious acception of the term, for Wyntoun modestly strives not to be original, but because it begins with the origin of things, the creation of the world. Macpherson omitted the whole of the first five books, except the few passages that refer to Britain, that is about the third part of the whole work. That was the fashion of the day, which we deplore now, as it renders almost valueless the noble editions of the old historians, published in the eighteenth century and even later. In spite of this drawback, Macpherson's edition is worth having, even now, for its accuracy, for its learned notes, and especially for its capital index by subjects.

The second edition forms part of the important collection of the "Historians of Scotland," which appeared in the seventies. David Laing was the editor. He has done an enormous amount of work, mostly good, in the field of Scottish literature, but it must be said that his last undertaking proved too much for his hand. He was an old man of nearly eighty when the first volume appeared, and the mere physical labour of seeing three substantial volumes through the press was more than he could do. I shall have to point out deficiencies in his edition as I go on, which cannot be helped, if we are to know exactly how matters stand with our Chronicler.

The edition was to be a reprint of Macpherson's, plus the omitted parts of the first five books; besides, the MSS. unknown to Macpherson were to be examined and collated, and the question of the revision and enlargement of the Chronicle by the author himself was to be considered. The first part, alone, of the programme was carried out satisfactorily. We have now a full text of the Royal MS., and, so far as I know, a fairly truthful one, were it not for the punctuation, which is very fantastic. The question of the revision of the Chronicle has been left untouched, except that Laing printed the Cottonian alterations twice, in the body of the work and in the variants, while Macpherson had given them once only, in the variants. As to the examination of the new MSS., that is where Laing failed most seriously. He had the good fortune to have in his hands three MSS. (Wemyss, Saint Andrews, Auchinleck), that had never been used or read before; but the information he has vouchsafed to us is very scanty, and, what is worse, it is inaccurate and misleading.

This brings me to the contents of the MSS.; but before I proceed any further, it is right to state that my knowledge of the subject is largely derived from two scholarly and original papers published by Mr W. A. Craigie, the one in the *Scottish Review* (July, 1897), and the other in "Anglia" (Vol. XX., 1898). Mr Craigie has gone to the root of the matter; that is to say, he has demonstrated plainly that the conclusions arrived at before him, as to the relations of the different texts, were wrong. Innes had formed a wrong opinion, Macpherson adopted it, and Laing repeated it.

Out of the nine old versions which we possess, three represent three different stages or editions of the Chronicle—the Wemyss is the earliest, the Royal the intermediate, and the Cottonian the last. The other six gravitate more or less regularly round them.

I shall have most to say about the Wemyss, as I know it best, and as it plays an important part in the genealogy of the different versions. Laing obtained possession of the manuscript while he was printing the last volume of his edition, so that he could not have made much use of it, even if he had desired to do so; but he must have been struck with the importance of his find, as he printed several extensive passages from it in his Appendix and elsewhere. High hopes were raised by the date assigned to the volume, hopes that have not been fulfilled. Laing describes it as of the early fifteenth century, and it would have been a priceless boon to have a text almost contemporary with the author; however, from the spelling and writing, we cannot place it higher than 1600. Probably, "early fifteenth" is a slip for "early sixteenth"; such slips are not uncommon with the editor. The text is complete at the beginning, a fortunate contrast with the other texts, two only of which contain the Prologue. There we find at once that we have to deal with the early edition. The Chronicle is divided into *seven* books, and

The sevint sall mak conclusioun
Off the nobill generatioun
And of the blessit gud lynnage
That come of the mariage
Off Malcolme king of Scotland
And Mergret aire till Yngland.

That is to say, the seventh book will end with the death of Alexander III. Such was the original purpose of Wyntoun. The chapters are numbered continuously, an arrangement that was changed afterwards, and readopted later. The headings or rubrics of the chapters are different from those of the other leading texts, and more appropriate to the contents. They play a great part in the classification of the manuscripts. Laing doubtless understood the value of these rubrics, for he took the trouble to print them in the Appendix; but there again the faculty of taking pains failed him. Their importance lies chiefly in the fact that they do not fall in with the divisions in the Royal which is a remodelled text; therefore, what the reader wishes to know is where the chapters begin and end in the Wemyss. Laing did make an attempt to indicate the commencement of each chapter, but out of the 196 headings, he left 50 blank, and gave the wrong indication in 26 cases.

So much for the framework; when we consider the text we find it rather perplexing. It is so different from all the others that if we were to divide them all into two classes, the Wemyss would stand alone in one class and all the rest in the second. The manuscript is late, however, and the scribe undoubtedly took liberties with his text, and so the question we have to face is which of the differences are due to the writer, and which belong to the original. The problem will perhaps never be solved completely, but it cannot even be attacked before we have the whole text in print. Besides what is different, there is also plenty that is new and has never seen the light of day. Those passages, which are scattered through the whole Chronicle, are more numerous in the later books, which of course enhances their value. Here are a few instances, selected for their briefness, and each with a point of interest of its own.

In the Fifth Book (ll. 1449-1480), Wyntoun narrates the story of Faustina, the daughter of the emperor "Antone the Mild," who fell so violently in love with a gladiator that she was "all lyk for to be dede." Her despairing husband summoned physicians from Caldé, who advised as the best remedy that the man should be slain, and that they should wash her body with his blood while it was hot. The remedy proved successful:

Hyr temptatyown cessyt sone,
And coveryt welle of hyr malady.

So ends the story in the usual form. The Wemyss adds the following remarks:

Bot methink heir wes litill skill,
That thay suld for hir wanton will
Sla a saikles man but law;
There was of God bot litill aw.
For gif ony suld haif bene slane,
It suld haif bene scho in certane
Erar than he that maid na cause;
Bot it is said in commone sawis
That mastry mawis the medow ay,
And sa fell heir, the suth to say.

The second last line preserves a curious Scottish proverb unrecorded hitherto, so far as I know.

More curious is an episode of the taking of Berwick on the Good Friday of 1296, when the English entered the town by treachery and slew the Scots all day, sparing neither sex nor age, till at last

This Kyng Edward saw in that tyde
A woman slayne, and off hyr syde
A barne he saw fall owt sprewland,
Besyd that woman slayne lyand,
"*Lasses, Lasses,*" than cryid he,
"Leve off, leve," that word suld be.
(VIII., ll. 1833-1838.)

Here the Wemyss adds:

And of this slauchter mare to speke,
As I herd say, Antone the Beke,
That than wes bischop of Durhame,
A cruell man and of felloune fame,
Enterit in thare with the formast,
And sa furth throuch the toune he past,
With his hand saynand for dispite,
And biddand thaim fast sla and smyte
The Scottis doune and nane to spaire.
He mycht be callit a clerk and maire,
He wes a bischop of the deuill,
That wes so reddy to ger do euill;
Forthy with him he has his meid
For all thai bodyis that he gert bleid.

Antony Bek was the *bête noire* of the Scots in the days of Edward I., and Wyntoun voices the feelings of his countrymen, but I do not see why this outburst is not found in the other texts.

Once at least our MS. rescues a name from oblivion. In 1377 a man of the Earl of March's retinue was slain by the English during a fair at Roxburgh, then in their possession. Hence the burning of Roxburgh, sundry raids and a victory for the Scots at Carham. The Wemyss alone gives the name of the hapless cause of that bloodshed:

He wes ane of his avne houshald (the Earl's)
Donald Taylzeour he wes cald.

My main object in calling attention to this couplet is that Bower tells the same story and leaves a blank space where the name should have been inserted: "Tandem contigit quemdam armigerum cubicularium comitis Marchiae D. Georgii de Dunbar." . . . (Goodall, II., 384.) In a foot-note three MSS. fill up the blank with "nomine de Dunbar," which is not satisfactory.

I said previously that Wyntoun first divided his Chronicle into seven books, which were to end with the death of Alexander III. He changed his mind early, as we see from the Prologue to the Seventh Book, which ends with these lines:

Swa now remanys my delyte
Thare successyowne for to wryte
Till Robert oure secownd king
Hys dayis had drevyn till endyng.

However, he keeps to his plan of having only seven books. His chapters follow evenly on to the death of Robert II. without any prologue for the eighth and ninth books, so that from the prologue of the seventh book to the end of the text, we have one continuous book numbering about eleven thousand lines, that is to say nearly equal to the whole of the first six books. The manuscript is a few leaves short at the end, but we know from the contents given at the beginning of the volume where it must have ended. Out of these eleven thousand lines, more than six thousand are not by Wyntoun, as he tells us himself; a few hundreds have been borrowed from Barbour's Bruce, and the accounts of the reigns of David and Robert II. were sent by an unknown friend and gratefully accepted by Wyntoun. I shall close my remarks on the Wemyss by pointing out that it does not give the passages from the Bruce in full, but refers at once to the poem. This may be due to the scribe, who is not above tampering with his text, but I am inclined to believe that we have here the original state of the Chronicle, as there are more references to Barbour than in the other versions, and they are all expressed in similar terms.

When we come to the Royal text we find a considerable change. The framework has been altered, the Chronicle is divided into *nine* books, the ninth treating of Robert the Second and his posterity. The chapters are re-numbered, each book beginning with chapter *one*, after the prologue. The metrical headings have been changed, not improved, I am sorry to say, and have frequently been shifted to other places, not always successfully. Each book is preceded by a short list of contents of chapters, which lists are not in the Wemyss. When we reach the end of Book VII. the narrative goes on with Book VIII. without any prologue or list of chapters, just like the Wemyss, which proves that the eighth book had not yet been detached, although the chapters are numbered 1, 2, 3. . . . The important changes begin towards the end of this book, which deals with the last years of David II. The variations are too complicated to be explained in detail; on the whole, they come to this: the Royal leaves out a whole chapter of the Wemyss, the fight of the thirty Frenchmen led by Beaumanoir against thirty Englishmen (VIII. 6637-6826), a good deal of the matter in the Wemyss is re-written or shifted, and new incidents are introduced. We are dealing here with the part not written by Wyntoun, so it is evident that the chronicler has taken in hand the revision of his friend's material, and has added to it. Book IX begins with a prologue and a list of chapters, unlike Book VIII., which has neither, but the prologue, from the style and versification, may be a later addition. The Royal agrees on the whole with the Wemyss till the end of the latter, or better, to the end of the unknown friend's share, the last line of which is

Amen, amen, pai cherite. IX., 1152.

The first edition probably ended here. Then Wyntoun states that he is not going to stop yet, but will go on and tell the more remarkable things which he has seen in his own time. This he does to the end of his Chronicle, about two thousand lines more.

The third change comes with the Cottonian, which proves to be a second revision. The MS. follows the Royal in the general arrangements of books, chapters, headings, prologues, etc., except that Book VIII. gets a prologue and list of chapters all to itself. The text, on the whole, is also the same, with the following exceptions, which are most important. In Book IV. Wyntoun has to relate the beginnings of the Scots and Picts in Scotland, his authorities being the genealogies and legends fabricated before his day, to prove that Scotland had been christianised, and had been ruled by kings long before England. Under the date 452 B.C., according to the Wemyss and Royal texts, the Scots began to reign in Scotland, their first king being Fergus More, son of Erc. Then follows a short account of a dozen of his successors, and Wyntoun promises that he

wyll spek mare thareoff swne,
Quhen all the lawe till it is dwne. IV. 1151-2.

Afterwards, he must have discovered another authority, a trustworthy one this time, that made Fergus the ancestor of Kenneth Macalpine, with ten generations only between them. Now, Kenneth reigned about 840 A.D., so the ten generations had to cover a length of 1,200 years, an average of 120 years for each. We know now how the trick had been done by the genealogy makers. They had simply lifted out a whole line of Scottish kings who in reality reigned between the fifth and the eighth centuries of our era, and placed them at the head of a more or less imaginary line of Pictish kings, so as to fill up the whole period between 450 B C. and 850 A.D. Wyntoun found the problem too hard to solve, so in the Cottonian he drops the whole account of

Fergus and his successors, explains the difficulties of the case, and adds—

> Gif othir, of mare sufficians,
> Can fynde bettyr accordance,
> This buk at likyn thai may mende. IV. 1147*.

Later in the same book, when the Picts appear on the scene two hundred years later, the passage is altered again on the same grounds.

The last alteration occurs in Book IX., at the beginning of the reign of Robert III. By sundry additions, omissions and re-adjustments, the final chapters are linked more firmly to the account of the last days of Robert II., and we are entitled to see there the last touches of the last revision of the Chronicle.

I shall dispose shortly of the remaining six MSS. Three are related to the three leading types, one to each, the other three are of a composite order.

The Harleian (17th cent.), was known to Macpherson, who used it sparingly, one might say reluctantly, for variants which give decidedly better readings than the Royal. Those variants agreeing exactly with the Wemyss, hopes were raised that the later MS. would be very useful to correct the vagaries of the earlier one, and to replace the few missing leaves. From testing inquiries it appears that it is an abridged copy of the Wemyss in its present state. Macpherson, probably misled by the lateness of the MS., accuses the transcriber of correcting Wyntoun from Hector Boyse. He does not substantiate his assertion in any way, and I do not think that the Wemyss can be later than Boyse; the copying, if there is any, may have been the other way. From an allusion to an abbot of Kelso, William of Dalgernow, tutor of David II., Macpherson thought that the manuscript must have been copied from one written in the abbey of Kelso, as he could find that piece of intelligence nowhere else. This surmise is wrong, as the passage was taken from the Wemyss, which came from Cambuskenneth.

The Lansdowne MS. (c. 1500) Macpherson had heard of, but he did not examine it, as the Marquis of Lansdowne of his day could not find it in his collection. That text was read for Laing, but he made little use of it, except to note the omitted lines, which are very numerous, a negative kind of information of slight value. A collation of the first book shows that the MS. belongs to the same class as the Royal, but is not copied from it.

The main features of the Cottonian type are reproduced in the First Edinburgh, also belonging to the early part of the sixteenth century. Unfortunately, it is defective at the beginning, and wants also a good many leaves at the end.

The first composite text I shall call your attention to is found in the Second Edinburgh, a very neatly written volume, perhaps a little earlier in date than the First Edinburgh. The MS. stands next to the Royal in completeness, and in the very first chapter (missing in most MSS.) we discover that the scribe was working with two texts. In the Wemyss version Wyntoun tells us that he will divide his work into *seven* books after the seven ages of the world, and in the second (Royal), he divides it into *nine*, after the nine orders of angels. The scribe of the Second Edinburgh copies four lines of the first statement about the *seven* books, then discovers that he is going wrong, misses a line quietly, and goes on with the text of the recension, giving the contents of the *nine* books. The text follows the Cottonian in the main, but the writer gives up the numberings and headings of chapters of the two later types, and goes back to the Wemyss for them. As the old headings do not always correspond in position with the new, he sometimes inserts the new ones in their places without numbering them. When he comes to the last part of David's reign he abandons the revised text and partly adopts the early one, which he does also in Book IX., where the last addition to the Chronicle begins.

The Auchinleck MS. comes to be examined next. Laing discovered it, as he tells us in his preface, where he gives a long account of his relations with the Boswell family; but when he comes to the MS., he has only one statement to make, and that statement is wrong. He finds fault with Sir Alex. Boswell for writing that his copy wants forty or fifty lines of what has been published. "But lines," adds Laing, "is evidently a misprint for leaves, as the MS. is so defective as to want the whole of the Fourth Book." As a matter of fact the MS. wants not only the fourth, but also the first, second, and third books, and parts of the fifth and ninth. Thanks to the generous courtesy of Mr John Ferguson of Duns, the owner of the only MS. of Wyntoun remaining in private hands, I have had the Auchinleck volume in my keeping for several months, and I have collated the whole of the original part. I was struck at once with its close resemblance to the Second Edinburgh, and after a hurried comparison of the two MSS. I have come provisionally to the conclusion that the Second Edinburgh is a copy (direct or indirect) of the Auchinleck. Here is one of my grounds for this belief. In Laing's edition, VIII. 5366-5372, are these lines:

Dowglas wes strykyn throw the body;
Bot he lywyd eftyr in gud hele.
Swa couth thai wyth thaire fais delle,
That thai ware rudly put agayne,
And off thare folk a few ware slayne;
Bot for thare gret ost, that wes by,
Dowglas wythdrw bym wyttily.

Opposite the first five lines, in the margin, the Auchinleck has in red ink the heading of chapter 171 (172 in Wemyss), which the scribe had forgotten to insert in the body of the text. The writer of the Second Edinburgh inserts it after the third line, that is to say in the middle of a sentence. It is not clear where the Auchinleck scribe meant the rubric to come in; in the Wemyss, it is rightly placed after l. 5324. A similar mistake occurs at least once again, but in such a complicated way that it cannot be set forth here. It is in connection with a remarkable passage of sixteen lines concerning the abbey of Restenot. The passage occurs at the end of Book V., and is only found in these two MSS. From internal evidence I feel inclined to believe that the lines are an interpolation, which may connect the Auchinleck (or its prototype) with that abbey.

The Auchinleck contains also a curious blunder due to copying from two versions. In chapter 181 = Laing's VIII., chap. XLIV., the writer begins with the revised text, copies two lines of it,

A thousand thre hundyre and fyfty yhere,
And the sext off oure Lord dere,

then inserts two lines from the Wemyss version of the same event,

That zeire the nobill kyng Ihone of France
Was tane at Poteris apone chance,

then returns to the third line of his former guide,

Wes borne, and all thir dedis dwne. . . .

thus making nonsense of the passage. The two intruding lines have been crossed by a later (?) hand, but there they stand, illustrating the mode of working of the copyist. The mistake is not in the Second Edinburgh.

The St Andrews MSS. also exhibits a combined text, only more so than the two preceding ones. I shall not trouble you with the details. Mr Craigie has brought them out fully in his Anglia paper, after a thorough study of the MS., showing conclusively that the three types have been employed. Here also the scribe has blundered more than once in his combinations. I am sorry to add that Laing has erred more than usual in his treatment of this manuscript; he has clearly misunderstood the nature of it, and his remarks are mostly unreliable.

In conclusion, we have nine old texts of Wyntoun's Chronicle, containing three different versions of some parts, and several combinations of those versions. Against that we have in print one text from one manuscript. The Royal may be the best, so far as it goes, but it is not perfect, and besides it does not contain many hundreds of lines scattered through the other texts. Wyntoun has been blamed for his bad grammar and halting versification; he is certainly not a stylist, yet his periods flow smoothly enough, except when he is struggling with a difficult piece of Latin, and the octosyllabic measure is such an easy-going jingle that one wonders why so many of his lines are too short or too long. The fact is that Wyntoun has suffered greatly from his transcribers, and a comparison of the unprinted texts with the printed one throws light on those supposed shortcomings.

I hope I have proved that historically and philologically, two points of view that should appeal to us, we should be gainers by knowing more about Wyntoun and his work. Wyntoun may not be a poet, but his Chronicle is a document of the highest value for the history and language of Scotland, and that document we have not in its entirety. The Scottish Text Society has long held that opinion, and has resolved at last that the Original Chronicle should be added to its volumes in as full a form as possible. It has been difficult to settle what that form should be. A critical edition is out of the question, for there never was a definite text; it grew, and changed, and shifted several times, and we cannot have these growths and changes represented in one text without altering its unity. I take it that what is wanted is an edition that will reproduce concisely and intelligibly all that is now hidden in the MSS. They are scattered all over the country, and no student can afford to consult them; if their contents were brought out in print, any one so inclined would be enabled to work out for himself some of the problems that have not been solved yet, and, let me add, the solutions will be various.

The first idea was to publish the three leading texts; that was given up as extravagant and impracticable. The Royal having been edited twice, we may rest satisfied with it as it is. The next was to make the Cottonian the only text; that would have been feasible but for the Wemyss that is so unlike it that almost every line would require a footnote. So it has been decided to give both the Cottonian and the Wemyss in parallel pages, with the variants of the other texts as footnotes. That will increase the number of pages, but if the printer and the editor do their duty, the whole matter will be clear, and we shall know for the first time all that Wyntoun wrote or others wrote for him.

I need scarcely add that I have been rash enough to assume the responsibility of this arduous undertaking. At the end of the eighteenth century Macpherson confessed that he had undertaken to edit Wyntoun because everybody declined to do it, in the hope that an edition by him would be better than no edition at all. At the beginning of the twentieth century history repeats itself.

XIV.—*On a Model for exhibiting a classification of the Consonantal Sounds of the English Language.* Shown by R. F. MUIRHEAD, M A., B.Sc.

[Read before the Society, 5th February, 1902.]

THE model in question was exhibited as an example of the advantage of using a three-dimensional figure for showing the classification of a set of objects according to three independent principles of classification.

The three principles of classification adopted for consonantal sounds were:—

(1) That with reference to the organs used for stopping the breath, giving the four classes of labials, lingual dentals, palatals, and sibilants.

(2) That with reference to the extent to which the vocal chords are allowed to sound during the stoppage, giving the three classes of hard, soft, and nasal consonants.

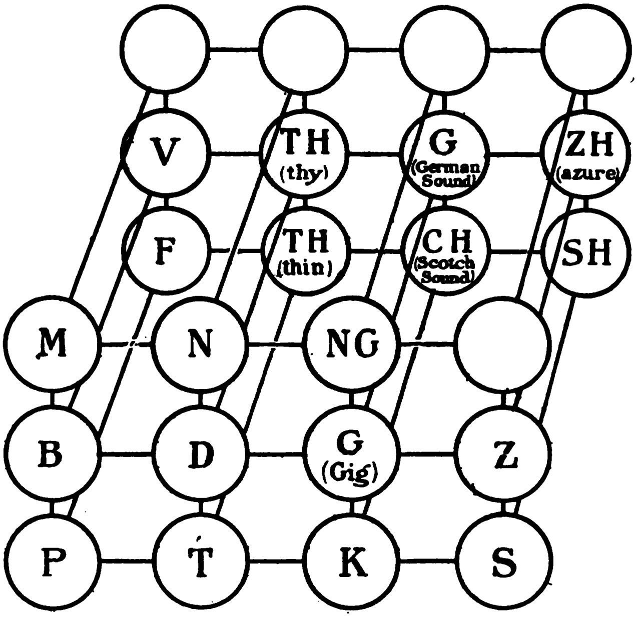
(3) That with reference to the closeness or openness of the stoppage, giving the two classes of smooth, close, or unaspirated, and rough, open or aspirated consonants.

The construction of the model, which formed a skeleton cuboidal frame, is indicated by the accompanying diagram.

Each of the nine planes contains a whole class. The line at the intersection of two planes contains those which belong to two independent classes, *e.g.*, the line M B P contains the hard consonants which are at the same time labials. Each letter lies in three planes which determine its classification in three ways.

It was pointed out that all the *simple* consonantal sounds of the English language, with the exception of those represented by *l* and *r*, find a place in the model, and that by including the

Scotch *ch* (as in loch), and the German aspirated *g* (as in Wagner), the places in the figure are all filled, with the exception



of the lines representing aspirate-nasals and sibilant-nasals, none of which exist in our language.

It was remarked that each classification gives one semi-consonant or semi-vowel class, *i.e.*, a consonant of which the sound by its nature can be indefinitely continued, and that the two lines of blanks are both intersections of two semi-consonant planes.

Certain imperfections in the classification thus shown were then pointed out, but while completeness and perfection were disclaimed, it was suggested that the model might be useful for teaching purposes, on account of the clearness with which it indicates the mutual relations of the consonants, and on account of its suggestiveness.

XV.—*History in the Romance of Golagros and Gawayne.* By GEORGE NEILSON, President of the Historical and Philological Section.

[Read before the Historical and Philological Section, 16th December, 1901.]

WHEN last we met it was under another designation than that we now officially bear. A change of name implies a change of purpose, and at this opening sitting of the "Historical and Philological Section" a word may be hazarded to put on record the causes inducing us to alter our title and widen our bounds. We professed Philology: we have now annexed History. The original Philological Section contributed from time to time to the *Proceedings* of the Society notable articles chiefly on questions wholly literary, or on the border line between philology and history. Although the word "Philological" was, in the section, interpreted in its most comprehensive sense, a feeling found utterance that freer scope for the historical and literary talent of the Society would be afforded by the adoption of a title more popular, while less formidable and restrictive, than "Philological." History is a word of wider appeal than Philology, perhaps possessing a higher degree of public attraction, as such more likely to draw recruits to the Society, and certainly offering fuller opportunity for that deep-seated intellectual interest which the past has never failed to command. Action followed upon the thought, and now with a broader definition of our special sphere, giving history a coordinate place with philology in our curriculum, we meet for the first time under the new conditions. The object for which we now exist as a section is constitutionally declared to be the promotion of study in history and philology. The least thing that can fittingly be said by one who has been so unexpectedly and so highly honoured as to be placed in the chair, is to express his gratification not less for the compliment thus rendered to himself, than for the convincing heartiness of determination displayed by the members to set the section at once into vigorous action along its reconstituted lines. The response thus readily given to the renewed appeal for co-operation on a revised basis, has been such as to justify an ardent hope that the kindly omens under which we begin, may be true portents of a powerful and enduring energy seeking a medium for zealous and original service to the studies we profess.

Although the constitution of the Society provides among other things for the establishment of a section relative to Archæology, that term was scrupulously set aside in the renaming of the section, in order to avoid even the appearance of rivalry with the Glasgow Archæological Society, which so admirably, and with such authority, watches over the archæology of the West of Scotland. Between its functions and ours there can be no conflict. The objects of the one are complementary to those of the other, and there is an amplitude of room for both. History and Philology comprehend much that Archæology does not claim. The three shade insensibly into each other, but History is the all-embracing term. How shall we do the best service in our gigantic province? The great triumph of the historical and critical scholar is to discover—whether it be new facts or words, or new relations between facts or words—and thus, in the place of a question, a doubt or a problem, to establish a certainty. This section will strangely belie its promise if its record in coming years shall prove barren of contributions of conclusive importance for problems of history and literature.

That for the present session our programme leans decisively towards themes wherein literature and history coalesce, is the result not of chance, but of design, partly due to the desire to avoid abrupt transitions and the wish to continue the philological tradition, partly due to the discovery that the material found available at the outset included a well defined series of special studies of and connected with early Scottish Literature. Great issues are at stake in that national field, and the time is opportune for their consideration. At the same time, the poets are to have no monopoly, as our prospective Syllabus of the session's papers will evince by its catholicity of interests beyond the literary confine. We are peculiarly happy in having secured not only patronage and countenance, but direct aid, from the professor of history and the professor of literature in our ancient University. Their cheerful accession to our ranks as active workers with us is the best guarantee of the measure of social and scholastic force behind the movement of culture, some small portion of which our studies may claim to represent.

Our staff, if I may presume to apply that name, includes both specialists in minute study and scholars more attracted by facts and influences of broader sweep—the men who busy themselves about chronological or textual foundations as contrasted with those who are not less nobly occupied in planning or rearing the large edifices of history or criticism. The interminable battle of these two schools, will, no doubt, fight itself out, peacefully, in our midst. The hopeless, if cordial, incapacity of the painful chronologer or verbal specialist to appreciate properly the philosophic summation of general causes, or the verdict of ultimate æsthetic criticism, may perhaps be chastened by the manifestation on the part of the thoroughbred historian or critic of at least a desire to disguise his holy horror of antiquarian or textual detail. On these heads we must all agree to differ before we begin.

Were it necessary to take formal steps towards reconciling such prospective animosities, a discreet chairman might do worse than to offer himself as a scapegoat by making his introductory deliverance a particularly glaring example of all the vices of the school he himself chiefly affects, while at the same time he endeavours to demonstrate how, rightly considered, he deserves to be reckoned by the opposite school as of the veriest salt of the earth. This amiable purpose has dictated my choice of a subject, which although of no small historical and philological moment to the attenuated circle of alliterative students, must be acknowledged to be caviare to the general, while nevertheless illustrating how the highest critical opinion may be affected by a minor revelation of research.

No general proposition sounds more of a platitude than the allegation that the first requisite of literary criticism is history. Yet the philologists have not been acting upon the principle, whatever they may say about it as doctrine. For a hundred years the alliterative poems have been a mystery sacred to the high priests of philology, some of whom have displayed a resentful spirit on seeing their temple invaded by a mere historical student, who believed that historical investigation proceeds on far safer lines than philological analysis. The results have been a surprise greater to none than to himself, for the disclosure of a whole chapter of historical narratives under cover of what seemed perfectly normal romance, was the last thing to be expected from such an effort of critical research.

The issue of recent labours[1] has been to reveal in the rimed-alliterative poem the *Awntyrs of Arthure*, a scarcely veiled narrative of Anglo-Scottish political incidents of 1358-1359; in the alliterative poem, *Wynnere and Wastoure*, an equally recognisable series of allusions to ecclesiastical and legal conflict in England of the same period, and less directly to Anglo-Scottish warfare and intrigue; and in the alliterative poem, *Morte Arthure*, a large array of indubitable borrowings for poetic ends, from military, naval, and political events of the years from 1346 until 1364. It was accordingly not without a cheerful prospect of something worth finding that sustained attention was directed to another poem, the long familiar, but hitherto not quite explained, romance of *Golagros and Gawayne*. This "knightly tale," known only through the unique and early print of Chepman and Millar, "in the south gait of Edinburgh," dated with much preciseness, 8th April, 1508, was the subject of passing remark by Sir David Lindsay, and by the author of the "Complaint of Scotland" towards the middle of the sixteenth century. It was edited by Pinkerton in 1792, reprinted by David Laing in 1827, re-edited by Sir Frederick Madden in 1839, and by Professor Moritz Trautmann in 1879, and last of all presented, with full and most scholarly apparatus, in the Scottish Text volume of *Scottish Alliterative Poems*, the standard performance of my eminent friend and colleague, Monsieur F. J. Amours, vice-president of this section.

To M. Amours we all owe so much of inestimable value in setting enquiring minds on the track of decisive canons of critical test in the alliterative field, that even in reaching conclusions on date, significance, and authorship, wide as the poles apart from his we pay the heartiest of homage to his earnest preliminary labours on the philological, glossarial, and metrical sides of this most interesting theme. If opposite views from his are here advanced, and some of them set down as axiomatic facts, it is in no spirit of controversy, but on the contrary, with the warmest acknowledgment of the generous aid of M. Amours, rendered sometimes in his book, sometimes by his counsel in conversation, sometimes, let me playfully say it, by his opposition where we have resolved to disagree. From my standpoint the case is clear that *Golagros* is of, or about, the same date as the *Awntyrs*, that it belongs to the time of the captivity in England of King John of France, that its analogies with the *Awntyrs* are numerous and intimate, and that both[1] are the work of "Huchown of the Awle Ryale," whose personality stands beautifully revealed by an autobiographical allusion in the *Awntyrs*, after five-and-a-half centuries of obscurity and doubt. Not to argue these views is the present task; it is to set forth grounds for the faith that, albeit unseen by so many distinguished editors, Scots, English, German, and French, *Golagros* in good sooth is a sufficiently true piece of romance-history of France.

---

[1] *Huchown of the Awle Ryale* (MacLehose & Sons, 1902), was passing through the press when the present address was delivered.

From this of course is excepted that part which deals with the misadventure of the maladroit Sir Kay with the dwarf, as well as other direct transfers from the *Perceval le Gallois* of Chrestien de Troyes.[2] A section of the plot of that romance utilised in the poem, is nevertheless so skilfully adapted to the historical situation, as to make difficult the task of determining where exactly romance shaded into narrative of allegorical or actual fact. Parallel columns below epitomise the knightly tale alongside of its historic prototype. The arts of historical persuasion may cease to be exercised with any prospect of success if the comparison leaves any doubt as to the purport of *Golagros and Gawayne.*

History.	*Golagros.*
In the autumn of 1355 Edward III., with a large army, including the chivalry of the then not long founded Round Table or Order of the Garter, crossed to Calais. In November he marched against King John seeking battle, which John avoided. There was great scarcity of victuals, and the expedition accomplished little (*Robert de Avesbury* [Rolls Series] p. 429 "fuit penuria potus . . . et considerans parcitatem victualium" . . .).	King Arthur, as pilgrim bound, turns toward Tuscany, and chooses his warriors of renown of his Round Table (ll. 1-15). After many days weary marching "all their vittalis was gone." (36.)

---

[1] "From the similarity of style, the peculiar construction of the stanza, and the subject, it is almost certain that the writer of the *Awntyrs of Arthure*, must also have been the author of *Golagros and Gawayne.*" Madden's *Syr Gawayne* (Bannatyne Club), pp. 327-8.

[2] *Perceval le Gallois ou Le Conte du Graal*, *ed.* Potvin. Mons. 1866.

History.	*Golagros.*
The city referred to in the poem seems clearly to be Bordeaux, the capital of Guienne, a powerful city, with walls, gates, and castle. [King Edward did not go to Bordeaux.]	The army approaches a city strongly fortified with walls, and gates, and castle, on the water-side (40-5). Sir Kay is sent into the city on an embassy in search of victuals (51). By his discourtesy he makes himself a laughing stock, as he does in *Perceval le Gallois*, (ll. 16365-506), and fails.
John de Grailly Captal de Buch, having gone to England, was high in favour of the Black Prince. In consequence of his representations, the Prince spoke to his father, Edward III., and suggested that he should send one of his sons to Gascony— En votre conseill que faissiez Envoier là un de vos filtz— (Chandos Herald's *Prince Noir*, ll. 523-44).	Sir Gawayne speaks to the King advising that a prudent man of gentler mood be sent instead. "I rede ye mak furth ane man mekar of mude, That will with fairnes fraist frendschip to fynd. (120.)
King and parliament resolve to send the Prince himself "pur ce que tant fut à priser." (Chandos Herald, l. 550). He receives commission as lieutenant of Aquitaine with orders to take homages and fealties in France (*Rymer*, 4th Aug. 1355, etc.).	Arthur bids him go as there is none so courteous as he. (124-5.)
Landing at Bordeaux the Prince was welcomed there with great rejoicing by the barons of the country. He set out on a brilliant expedition on 5th October, 1355, across the isthmus from the Bay of Biscay to the Mediterranean. Many towns	The gates are at once opened to him (127), and the lord of the castle in reply to a request to sell victuals, refuses to sell, proclaiming that Arthur is his lord, and that all is his own. (146.)

History.	*Golagros.*
and castles were surrendered to him *(Galf. le Baker*, 231-7, *Jehan le Bel*, ii. 187-9). He was received and entertained *(hospitabatur)* in not a few *(e.g.*, *Galf.*, 231, 234, 235, 239).	“This kyth and this castell, Firth, forest, and fell Ay quhill you likis to dwell, Ressave as your awin.” (192-5).
The barons of Gascony follow the banner of the Prince. The Spynagros[1] of the poem is pretty obviously John de Grailly, the famous Captal de Buch who did splendid service to the English cause. It was (according to Chandos Herald's *Prince Noir*, l. 524, p. 319), owing to the Captal's initiative that the Black Prince went to Bordeaux and undertook the campaign in Aquitaine. Chandos Herald repeatedly indicates his importance, ll. 525, 678, cf. *Galf.* 232.	The lord of the castle, moreover, offers Arthur 30,000 troops (197.) His name is Spynagros, and he is throughout the poem the companion, guide, and counsellor of Gawayne. (261, 341, 506, etc.).
The Black Prince landed in Bordeaux on the 1st, and marched away on the 5th of October, 1355 (*Galf.* 229). During these four days there were great celebrations. “Receptus est cum honore” (*Galf.* 229), “Moult fesoient grantz reveaux” (Chandos Herald, l. 617).	Between the arrival at and departure from the city four days elapse, marked by great festivities. Thus they solaist thame selvin suthly to say, Al thay four days to end, The King thankit the heynd Syne tuke his leve for to wend, And went on his way. (217-21).

---

[1] There was a romance personage Espinogres, not however playing any such part as our alliterative poet assigns to him here. Our poet in his spelling too, makes a variation which readily and roughly rendered, would denote “Spinny” *(Gawayne and Green Knight*, ll. 1709, 1896), and “gross” or *spinetum grossum*, the great thorn-bush, a round-about equivalent of the Captal's local name *de Bosco* (Galf. 232), or *de Buche* (Avesbury [Rolls Series] 457).

History.	*Golagros.*
The Prince's distant journey lay over mountainous tracts (*Galf.*, 232, 242, "transitus erat difficilis arctus et montuosus.")	Throu mony fer contray Our the mountains gay, Holtis and hills. (232-4) With his army passed in all the pomp of chivalry— The Prince provit in prese that prise wes and deir. (234-5).
On 3rd November, 1355, the Prince's army had nearly crossed the isthmus, having reached Carcassonne (clearly the place indicated by the poet), a city with a castle on a great rock, girt with a double wall, seated on the river Aude—not far west of Narbonne on the Mediterranean. This castle-city is still famous for its towers, which aligned in a great oval circuit are truly enough "on raw," and of which fifty-four now stand. (*Galf.* 235 styles Carcassonne "civitatem circumcinctam duplici muro.") For a historical description see M. Viollet le Duc's *La Cité de Carcassonne* (Paris 1888), with its plan of the fifty-four towers (p. 85). It had an interior and exterior enceinte and "du côté nord-est de l'est et du sud . . . de larges fossés protégent la première enceinte." (p. 33).	They came to a walled place high on a rock, double diked on a river beside the sea. Syne war they ware of ane wane wrocht with ane wall, Reirdit on ane riche roch beside ane riveir, With doubill dikis bedene drawin our all. On that river he saw Cumly towris to knaw The roy rekinnit on raw Thretty and three. Apone that rich river randonit full even, The side walls were set sad to the sea, Schippis sailand them by sexty and seven. (230-50).
Carcassonne had a round keep, built in the twelfth century —the commanding feature of a fortification described by the author cited as one of the most	Incidentally it is mentioned that the fortress includes as its distinguishing feature a circular keep, for the messengers sent to demand homage go thither—

History.	*Golagros.*
complete and formidable defences in mediæval Europe (p. 84). This moated round tower is ascribed to the prudence of St. Louis who, "fit bâtir la grosse défense circulaire appelée la Barbacane" (p. 17). It was demolished early in the nineteenth century. "Cette destruction est à jamais regrettable car au dire de ceux qui ont vu ce bel ouvrage il produisait un grand effet et était élevé en beaux materiaux" (pp. 69-70). A sketch of it, as restored, appears on p. 75, and a ground plan of the city, castle and "Barbacane" on p. 85. The latter also appears in V. le Duc's *Dictionnaire*, i. p. 353	they "raik into the round hald." (371.)
Many castles and cities summoned to surrender submitted to the Prince. (*Galf.* 231-5). Not so the castle and old city of Carcassonne.	Enquiring of whom the lord of this land holds, Arthur is told that the lord of it holds of no man alive. Arthur vows to exact homage. (257-73.)
At Carcassonne the Mediterranean was of course near, though the ships "sixty and seven" were more likely to be seen at Narbonne, the next considerable place touched by the Prince's raid, which stopped some miles short of Montpellier (*Galf.*, 239, *Jehan le Bel*, ii. 188), on the direct road for Rome and about 40 miles from the Rhone.	First, however, he completes his pilgrimage[1]—a romance episode—to the "city of Christ" over the salt flood (302), and back (304). Then he rides on the ready way to Rome (perhaps a misprint, as Sir F. Madden and M. Amours think, for Rone).

---

[1] "Arthur Jerosolimam perrexit" so said old tradition recorded in Nennius, *Monumenta Historica Britannica*, 73.

History.	*Golagros.*
Edward III. was renowned as "gloriosus," and specially "mansuetus," and "graciosus" (*Murimuth* 225-6 *Walsingham* under year 1377.)	Arthur's magnificence is described (402-5) with special reference to his "manneris full menskful." (407.)
At Carcassonne the lower town which was without defences was occupied and burnt, but the castle-city after negotiations which came to nothing, defied attack, and on 6th Nov. the Prince marched away (*Galf.*, 236, *Jehan le Bel*, ii. 188. Moisant's *Le Prince Noir en Aquitaine*, 36). Sir Golagros (whose name remains unexplained and does not occur in *Perceval*), must denote King John.	Sir Gawayne is sent to the "round hald" of the castle to ask the allegiance of its lord Sir Golagros. (389-427). Sir Golagros refuses: he will hold his freedom as his forefathers did. (452). He is himself royal (359, 396), a soverane (360) whose ancestors have been independent kings:— "Ringand in rialte and reullit thame self evin." (1041.) Message is sent to Arthur of this refusal, whereupon:—
There had been heavy shipment of arms for the campaign of the Prince. Chandos Herald (ll. 602-8), says, Quil fist carker toutz ses vessealx. Hauberks helmes launces escutz, Arcs saectes et encor plus, Fist toutz ses chivalx eskipper, Et assetz tost se mist à mer Et tout lui nobles chivaler.	Mony sege over the sea to the city socht; Shipmen over the stream they stithil full straight; With alkyn weapons I wis that wes for were wroght. (459-61.)
M. Viollet le Duc says, that at Carcassonne, "le sommet des tours était garni de hourds en charpente" (p. 23).	Preparations for hostilities include the making ready of "hurdys" of tree, whether for attack or defence is not clear. (470.)
In the renewed campaign of	Battle breaks out and various

History.

1356, various fights and sieges (*Galf.* 248-9) preceded the battle of Poitiers.

The names opposite, though not present in *Perceval,* are in part those of known romance personages *i.e.*, Gaudifeir, Ewin, Bedwar, Gyromalance, Cador.

But as regards Gaudifeir it is odd that one of the prisoners taken at Poitiers was Gadifer de Sancto Martino, who appears to have remained prisoner in England for some time (Rymer 28 July 1357). A knight named Gordon (bearing no doubt the three boar-heads of that family. Woodward's *Heraldry,* 227), was killed at Poitiers, and Sir John Gordon was taken prisoner (Michel's *Les Ecossais en France,* i. 68; *Rotuli Scotiæ,* i. 808, 824).

Sir Bantallas is probably a disguise for Bentley. In the campaign of 1355 on the English side was Sir Walter Bentley, a distinguished soldier of the period, victor in the battle of Mauron in 1352 (*Avesbury* [Rolls Series] 415-7). He had protection for service in France in 1355. *Rotuli Franciæ,* 7th Aug., 1355.

Sir Sangvel is probably "An-

Golagros.

combats are mentioned between individual knights.

For Arthur.		*For Golagros.*
Gaudifeir	captures	Galiot. (583).
Schir Rannald, "thre ber-hedis he bair"	kills and is killed by	Schir Rigal of Rone. (641).
Schir Lyonel	is captured by	Schir Lowes. (713).
Schir Ewin	kills	Schir Edmond. (715).
Schir Bedwar	is captured by	Schir Bantellas. (717).
Gyromalance	captures	Schir Sangvel. (724).
Schir Cador	captures	Schir Agalas. (768).
Schir Owales	is taken by	Schir Ewmond. (765).
Schir Iwell	is taken by	Schir Mychin. (765).
Schir Myreot.		Schir Meligor.

Another combatant[1] on the

---

[1] Assuming that those coincidences of personal names are not chance—which they can hardly be—our poet must have been slily playing hide and seek with his allusions, probably to persons with several of whom, on the occasion of his poem, he may have come in contact. Note how Gaudifeir has had his part reversed; how Bantellas fights under Golagros; and how Sangvel does the

History.	*Golagros.*
dreas de Sankeville, Chivaler" who received protection in respect of his being about to proceed to France in the summer of 1355. *Rotuli Franciæ*, 30th May, 1355.	side of Golagros (742), taken prisoner, is Schir Hew. (768).
Lyonel and Edmond were the names of two of the Black Prince's brothers. Sir Ewin (if taken as the Celtic equivalent of John), may be the third brother. Louis was one of the sons of King John of France, and was in command of one of the four divisions of the French army at Poitiers.	
At Carcassonne there is mention of the "Tour de Notre-Dame dite aussi de Rigal" (V. le Duc. *op. cit.*, p. 76). Amongst the slain at Poitiers was Regnauld Chaveau. (*Froissart*).	
At Poitiers King John royally armed rode a white charger. "Si estoit li roys de Franche montés sour ung blancq courssier." (*Amiens MS. of Froissart* quoted by M. Polain in *Jehan le Bel*, ii. 302).	After these various encounters the tale centres on that of Gawayne and Golagros. Golagros is armed in red gold (886) and mounted on a white charger—"ane blonk of ane blee white." (895.)
Chandos Herald (ll. 1347-52) says that King John fought most valiantly, but that the Prince	There is a long and fierce duel ending in a victory of Gawayne.

---

same; while Gyromalance an undoubted French champion in romance fights under Arthur. These strongly savour of a game of *vice versa*, and appropriately enough "Sir Hew," most likely the poet himself, modestly ranks himself among the prisoners. Historically Sir Hew of Eglintoun was a prisoner in 1342. Where he was between 1348 and 1357 is not known. See the biographical calendar in my *Sir Hew of Eglintoun.—Proceedings* Philosophical Society, 1900-01.

History.	*Golagros.*
assailed him so vigorously that he was captured. Froissart gives a different account of the circumstances under which King John fighting heroically with his battle axe had to surrender, after some scruples as to whom the surrender should be made.	"Sir Golagros graithly gan ga Grovelings to earth." (1024.) He surrenders stipulating first (as was done in *Perceval* ll. 19232-70) that he shall be made to appear to his lady not as the vanquished but as the victor. To this Gawayne agrees.
The King is taken to the "loge" of the Prince who at supper served as humbly as he could his illustrious prisoner, declaring himself not worthy to sit at the same table. *(Jehan le Bel*, ii. 201, also *Froissart.)*	Gawayne is taken to the chief castle of Golagros—"the castel whare I have maist cure,"—where at supper he is set at the dais and Golagros waits in person upon his captor-guest. "And ay the merriest on mold marshalled at meat." (1160.)
[When the Prince conducted the King to London the King rode a white charger, while the Prince sat on a small black hackney, *(Froissart)*.	Golagros then makes known to the company the true position, tells the praise of Gawayne's prowess (1207), and makes him manrent with his hand. (1217.)
In 1358 a concord was arrived at, expressed in a treaty which fell through because unconfirmed in France. Jehan le Bel says that about the middle of the year 1358, this peace was made, when the kings kissed each other and promised to be "aydans et confortans l'ung l'aultre encontre tous," but he adds that the precise terms of the peace were not publicly known. (*Jehan le Bel*, ii., p. 203.)]	Gawayne and others with sixty torches, conduct with royal array Golagros to Arthur. (1276.) Golagros promises all his service to the King (1292), owning his defeat by Gawayne and telling what had befallen. Arthur commends Gawayne's generosity saying, "This is ane soveranefull thing, be Jhesu! think I." (1304.) He thanks Golagros and tells him the affair makes him gladder than all the rents from here to Roncesvalles. (1313).

History.	*Golagros.*
At the time of this concord there was a great festival at Windsor. (*Jehan le Bel*, ii. 205.)	Golagros does homage and fealty for all his lands, (1322-4) There is a week's hunting and festival. "On the riche river of Rone ryot thai maid," and on the ninth day Arthur and his men set off for home. (1348.)
[In 1358 the "temporalty" was a great theme of legal and political discussion through the conflict between the English judges and the Bishop of Ely. (*Scalacromia* 177.) No such release of King John as is in the poem granted to Golagros ever occurred, but it was the object aimed at in 1358 and 1359 by the Scots and French.[1]]	Before starting Arthur grants to Golagros "as touching the temporalty" release from his allegiance. (1358.)

The many telling points of contrast and comparison, incidents common to *Golagros and Gawayne*, and to Anglo-French history, are almost without exception features only attributable to the alliterative poet; they are not borrowed from *Perceval le Gallois.*[2] The city and castle answering to Bordeaux; the suggestion which educed the commision to Gawayne, answering to that which gave the Black Prince his lieutenancy of Aquitaine; the shipping of troops and apparel of war; the open gates and welcome of the city to the prince; the four days of festive sojourn there before the expedition set off; the long march over the mountains; the rock-founded, many-towered, and double-dyked city with round hold, answering so absolutely to Carcassonne; the introduction of Spynagros, who so readily lends himself to historical identification with the gallant Captal de Buch; the intruded personages, Gaudifeir, Sir Bantellas, and Sir Sangvel, so quaintly recognisable in the records; the white horse of the vanquished combatant in the battle between Golagros and Gawayne answering to that of King John at Poitiers; and the ceremonial of a seeming captor waiting at table, and in person, upon his seeming prisoner, so significantly answering to the deferential attendance of the Black Prince upon his real prisoner, King John—those things, neither taken from *Perceval* nor rising from it, are the all-important elements of the alliterative romance, observing there almost exactly the same consecutive order as their prototypes of fact did in the annals of England and France. So largely do they bulk that the resulting difficulty is to determine whether the poem has its larger interest considered as a piece of romance poetry or as a poetical chronicle only half allegorical. We have, for centuries, been lazily dreaming it was sheer romance; we wake to find it three parts history—a most singular memorial of the Black Prince's "terrible and wonderful march," as a contemporary[1] called it, in 1355, and of his glorious victory in the following year. This demonstration alters utterly the basis of criticism, and aptly illustrates the tremendous influence external facts have on estimates of literature. The moral is, that philology is not safe to walk by itself, but must hold history by the hand With the exception of the introductory incident of Kay the surly Seneschal, his altercation with a dwarf roasting a peacock, and his getting himself soundly belaboured with the fowl for his pains, the whole poem is a narrative of such circumstantial fidelity to fact, as to render at once void any canon of judgment upon its solidarity and coherence as a free-standing romance. The poet is severely conditioned by his business; he is working within the close limits of political allegory addressed to his own time. Romance may serve as the handmaid of festive chivalric chronicle. Or, a chapter of chronicle may become an ornament of chivalric romance. The canon of test for the product as literature in either case must differ enormously from the canon applicable to a work which, for plot, and incident, and theme, has untrammeled poetic license. Plainly in the contrasted types Pegasus runs in two very different chariots, and the high paces with which he curvets among the stars in the infinite freedom of art, are not to be expected where a wain-load of contemporary chronicle, possibly ephemeral, lumbers at his heels. That the mass of such literal chronicle incorporated in not one but several of the alliterative poems, has for five centuries eluded critical detection is probably the very best testimony to the completeness of that immaginative fusion which is a primary constituent of all literary creation.

---

[1] To this time, *circa* 1358-59, falls to be assigned the Golagros poem. For similar praise of Edward III. from a French captive's pen, see the poem of Gasse de la Bigne, the *Deduits de la Chasse* described in La Curne de Ste. Palaye's *Memoires sur l'ancienne Chevalerie*, ed. 1826, ii., p. 426.

[2] The lines of *Perceval* comprising the part of the story to some extent utilised, are from 16331 to 16624, and from 18209 to 19450. Compare also Amours' *Scottish Alliterative Poems*, pp. xix.-xx., 253-4.

---

[1] *Avesbury* (Rolls Series) 434.

XVI.—*Notes on Rural and Suburban Life in Scotland in the "Thirties."* By DAVID LAMB.

[Read before the Historical and Philological Section, 17th Feb., 1902.]

I HAVE to preface my few remarks to you this evening by an explanation which is much in the nature of an apology.

I was born in a country town (Kilmarnock), but I know very little of country life from any personal experience. I am to all intents and purposes a town man, and I love the tall tenement and the pavement. After a short period in the country I weary for a look at the crowd, and my heart gladdens when "I smell the smoke." I have heard of a boy who refused to drink milk when for the first time he had seen it "squeezed out of a beastly cow" —his had always come from a shop. You may therefore understand my position as regards country life generally when I say that my—can I call it "experience"? has been shop bought.

In the excellent paper read by our friend Dr Colville we were treated to an exposition of the Literary Renaissance of our country. During those "Thirties" which form the subtitle of my remarks there was something more than a Renaissance in social and political affairs, not only in Scotland but all over Europe. Exclusion from participation in the management of their own national affairs was becoming insufferable to the common people, and the ignorant loyalty to governments, so much desiderated by the august master of the wily Prince Metternich, was receiving the beginnings of those shocks which so shortly afterwards destroyed it. "I want obedient subjects," said the Emperor Francis to the professors at Laybach; "I do not want learned men." Mackenzie in his "Nineteenth Century," says, "the events of 1830 may be said to mark the complete political awakening of Europe," and after touching on the effect on the Continent, he goes on—"the peoples of Great Britain quelled the obstinate resistence of their privileged class, and entered on the possession of their right of self-government."

In the larger cities there was, naturally, the neucleus of the many political and social agencies which were scattered broadcast over Europe, and Scotland formed no exception to this very general rule.

The political condition of the country was lamentable. The people in the counties were utterly excluded from any part in the representation. The voters in these in 1830 did not number more than 2,000. In Bute there was but one single voter resident in the county, and at an election, where he was also a candidate, this man took the chair, proposed and seconded his own return, and announced himself unanimously elected.

In our own neighbourhood, the burghers of Paisley, Dumbarton, Kilmarnock and Rutherglen played a prominent part in the stirring events of the earlier part of the decade, and what was true of one town was equally true of all. In politics the Reform Bill was the all absorbing topic. For nearly thirteen years the agitation had been carried on, and in 1832 the hopes of the people were in large measure realised. In the district up the Clyde valley, which may serve as a good example, weaving was carried on to a large extent. Weavers earned somewhat better pay than colliers, miners, or other tradesmen. Their average wage was from 16s. to 18s. per week, while a weaver could make 20s. to 22s. 6d. My authority for this is an old friend well over eighty, who in the thirties sat at a loom. The period was remarkable as a time of transition, the old order was passing away, the new had not yet come. The power loom was in its infancy. Much spinning was done by machinery, but weaving was done by hand. Spinning by the spinning wheel was the work of the women of the families, and took up their spare time. The materials were wool and flax only, and the yarn was coarse in texture.

The weaving was a cottage industry. The factory system was not yet in existence, the machinery of the handloom was not heavy or expensive, the labour did not require, as it now does, to go to the machinery, the machinery went to the labour, hence hand-loom weaving existed in every village over the whole country. As evidencing this, let me give some figures for districts widely apart from each other. Kinross, in 1834, had 400 weavers; New-mills—I observe it was spelt so, and not Newmilns—had 700. The whole parish of Falkland lived on Glasgow, the men weaving, the women knitting. Dunse was the same, Whitburn was chiefly weaving, Kilmalcolm wholly so, and in the parish of Dysart, in

1831, there were 2,088 looms producing material valued at £150,236 stg.

Just before our period, the village weavers were called "customer weavers," and made the farmers' own yarns into blankets, druggets. tweeds, and women's plain dress stuffs. Cotton weaving was different from woollen weaving. The powerloom of 1830, though a simple contrivance, could weave plain calico or muslin, and this class of weaving ceased to be a cottage industry, and went into the factories. It was not till the fifties that the powerloom became so perfected as to be able to work fancy weaves and designs, and from that moment it pressed out and superseded the handloom, which is now only used for patterns, and such expensive and complicated designs as the powerloom cannot overtake.

The several branches of the textile industry gravitated to particular districts from economic causes. Cotton, requiring power was almost wholly confined to Lanarkshire, the supply of coal and labour controlling the situation, and Fifeshire absorbed the linen industry. Wool, being still woven by hand, was to some extent regulated by the presence of sheep. In the south there was the fine breed of cheviots, and the wool came down the western valley where the G. and S. W. railway now runs, and the towns of Stewarton, Kilmarnock, Cummock, and Dumfries, became woollen weaving centres. On the east valley where the N.B. railway passes there was a similar situation, and Galashiels, Selkirk, Hawick, and Langholm became the tweed district of Scotland. The Caledonian railway took the short course over the hill country in the middle, and hence on that line from Glasgow to Carlisle there is no woollen town. The whole of the Scotch weaving of the period was of the plainest character, with one notable exception. This was the Paisley shawl trade, an industry which developed the highest technical skill, and produced articles of great beauty and value. These goods were an attempt, and a successful attempt, to imitate by shuttle and loom the harness effects produced by the Indians with the needle or embroidery. The trade was at its best in the thirties, but in the sixties it decayed from change of fashion, and is now extinct. Shawls are not wanted, but dress materials of equal beauty are made by the powerloom, and the technical skill of the Paisley weaver is reproduced in the trained mechanic who perfects the loom.

Early in the thirties a change had taken place in the weaving trade. The yarns were now being spun in factories, but the weaving, though still practically a cottage industry, was not being done in the house proper, nor by the workers on their own account. The men worked in groups, and for the Glasgow manufacturers, whose vans delivered the warp and the pins for the weft, and collected the "wab" when it was finished. The looms were set up in rooms built or provided for the purpose, and "loom room" was let at about 10s. per annum. It was common that eight looms were set up in each of these rooms. The weavers did not deal directly with the manufacturers, but with the middlemen or agents, who, in the district of Clydesdale, lived about the Hamilton district, and who superintended the work all the way from Douglas citywards.

In Paisley the records show that in 1831 the working hours were—April till September, from 6 a.m. till dusk, lamps not being lit, and in the other months from 6 a.m. till 10 p.m., and not infrequently later. The apprentices were required to "chap up" their masters at 5.30, and woe betide the callant who was late. Dinner was taken at 2, and they "knocked aff" at 6 for a cup o' tea. There was, however, frequent cessation of work, specially when the *Glasgow Chronicle* arrived in the villages. This was three times weekly, and it was customary, all over, that the looms were stopped while its contents were read and discussed.

Up till 1836 there was not only a heavy paper duty, but an impost of 4d. per copy on the newspaper, and the people in the country towns formed newspaper clubs. In the outlying districts it was common to meet in the evenings to "hear the news," and then the copy was passed from house-to-house among the farmers. My father, who was a country apprentice at the time, tells me that the tailors in his master's employment subscribed for two journals, which were afterwards auctioned. A little later, when he was a journeyman in the city, a similar practice obtained, and each man had to read one half hour daily. As he had had a somewhat superior education, and was a good reader, not only did he do his own half hour, but he often read for other men, who carried on his work meantime.

If there were a gathering of friends the men usually retired to the weaving room, and over a stoup o' yill and a neighbourly exchange of the snuff-mull or a draw out of a pipe, they settled the affairs of the nation. This is not the place to discuss the Reform Bill, which has been called the "greatest political factor of the Nineteenth Century," and suffice it to say that having got rid of the Autocracy of Castlereagh the weavers of the Glasgow suburbs threw themselves, heart and soul, into their support of Earl Grey and Lord John Russell who first, in 1828, brought about the repeal of the Test Act, and four years later triumphantly carried the larger measure. Despite the ban upon public meetings, meetings were held, and in this these working people shewed themselves to be made of sterner stuff than the well dressed and better off people of the Capital, where, during twenty years there had not been any public meeting of a political character, and we may thus claim that the weavers of Scotland gallantly backed up the Reform Party in the "House."

The agricultural section of the community was not tarred with the same brush. From the middle of the previous decade there had been a growing feeling in favour of a freer commercial intercourse, and the possibility of the reduction upon imported food stuffs conjured up visions of hard times. The farmers of Scotland were strong protectionists. At their meetings at the weekly market in their nearest town, the danger to their interests was the all absorbing topic, and even at the parish curling matches the game not infrequently played only second fiddle. Farming under existing conditions was not so profitable a job, and a little later the defective harvests of 1836, '37, '38, brought many farms to the hammer.

In 1838 the most terrific snow-storm ever recorded occurred over almost the whole of Scotland. 1837 closed with snow, but it soon melted. January and the first ten days of February were mild, but on the 13th the snow came. Small flakes fell for about six hours and then big ones. For thirty hours it fell unceasingly. Then followed frost, sharp and during. Stock perished everywhere, the roads were impassable—the country seemed at a standstill. March found it little better. April was still in its clutches, and Mr Milne, the author of "Reminiscences of an Old Boy," tells us that on the 27th of May he saw farmers in his part of the country harrowing over snow wreaths.

In the thirties Agriculture was a much more primitive science than in these later days, and the harvest was reaped by the hand hook, smooth or toothed. There were three methods of harvesting. One was to hire a band and offer so much and a small premium for despatch. But this gave rise to "kemping," which meant carelessness in cutting, and resulted in a loss both of grain and straw. The second method was by the day. This was supposed to prevent "kemping" and induce more care and so make up for the extra cost. "Threaving" was the third system. By this, each reaper was paid by the number of threaves—a threave being two stooks of twelve sheaves each. My father says 1¼d. per stook, *i.e.*, 2½d. per threave, was about the average pay. It was not till 1840 that grain was cut by the long scythe. Agricultural labourers were poorly paid, 6d. to 8d. per day and food, or 1s. and feed themselves, but in the better districts in Scotland an ordinary farm servant got £7 to £8, and a good ploughman about £12 besides his board and sleeping accommodation in some place "aboot or abune the horses." Milk was scarce all over the country, the farmer preferring to "kirn," but the man or maid who served did not lack a plentiful if homely fare.

There was not much tea though : that was a luxury reserved for Sundays—tea was 5s. per lb., sugar 8d. By milk I mean sweet milk. Buttermilk could be had almost for the asking, and one farmer of whom I have been told, earned a opprobrious nickname because he carted it to a neighbouring town and sold it. Despite their hard lot, the farmers of Scotland in these times were a sturdy genial set. Their hospitality was unstinted, and they were generally good men at a bottle. It is told of one that on a market day he had been entertained by some gentry. There was a copious supply of champagne, and our friend had been helped, as his hosts thought, liberally. On his way home he met the parson, who, knowing his man's capacity, was astonished at his condition. "Dear me! what's gane wrang wi' ye?" "I'm deein', Sir, I'm sure I'm deein', or if I'm no, I maun be failin' sairly, for I wis but takin' a dram ; only aucht tumblers, Sir, only aucht, an' I'm fou, Sir, I'm fou."

The farmers of the Merse were hard drinkers. Returning from the weekly market at Haddington, they often went en masse into the Danskein Inn, and so prolonged the unhappy moment of going home, that it was wont to be said, the next market day surprised many of them where they sat. If they had been Frenchmen of the day when one glass served a company, they would not have needed the host's injunction—" No heel taps, gentlemen," to induce them to leave the glass empty before passing to their next neighbours.

At Candlemas at most south country farms there was great rejoicing and all kinds of games, while throughout rural Scotland generally old Christmas Eve and Hallowe'en were celebrated in grand style, even the beggar being welcomed in the farm kitchen. As regards Mendicancy, few farmers ever refused lodgement in their barns or a gowpenful of pease or oatmeal to the vagrant. It was during our decade, in 1833, that the privileged class of beggars known as the King's Bedesmen or Blue-gowns ceased to exist, and from 1824 till 1834, Kirk-Sessions of many northern parishes granted begging certificates to widows and others in necessitous circumstances.

There was another small source of income which was not despised by the coast or the inlying farmer. In the thirties smuggling was carried on to a very large extent, and the farmers were often art and part in so far as lending places of concealment. In the year 1800, 10,000 gallons of foreign spirit were smuggled into Scotland, but the commutation law assailed the contrabandist and illicit distillation became rife. With the men engaged in those practices there was much sympathy among the rural population, and even the clergy winked at them. A keg of French brandy, and later, something tasty from a sma' still went far to quicken the ecclesiastical conscience. Sometimes, however, things were done too openly and the clergy had perforce to speak. The minister of Rosneath tackled a parishioner and pointed out the folly of his ways, but it was to little purpose. "I allow nae sweerin' at the still," said the farmer, "everything's done dacently an' in order, an' for the life o' me I canna see ony harm in it." All through the Highlands there was a very general indignation over the distilling penalties, as the whisky helped to pay the farmer's rent.

The Parish School system has done a great deal for Scotland, and thanks to it there was a much lower percentage of illiterates in our country than in the other parts of the United Kingdom, (in England in 1833 only one person in eleven attended school), but the days of the palatial edifice erected in the cause of education and supported by the public rates as the outcome of compulsion, were as yet far in the future, and in the outlying districts not more than one-half of the boys and girls were sent to school. When they were, the leaving certificate gave them little concern for reading and writing and a trifle of coontin', were the end-all and be-all of their attendance. In 1830 only parish schoolmasters had fixed salaries. Dame schools were common for the younger children. Some of these ladies had not much learning, and it is recorded of one that when a "more than ornar" word in Bible Reading staggered an urchin, she used to say, "Spell it ma laddie." "Oh, that maun be Jeroosalem, go on ma callant," and a male teacher in Bowriefauld in the parish of Dunnichen was wont to write "P.S." above a long nebbit word, which was understood to mean—"pass this over." Fees were small, but such as they were they were not always forthcoming, and a friend we interviewed told Dr Colville and myself that the tippence a week paid for his education was a matter of consideration to his mother, and was very often grudged.

In some places the parish schools were bountifully endowed. Closeburn in Dumfries is a case in point. The school was and is yet in a state of very high efficiency, and the master drew his revenue from a splendid glebe and lived like a country gentleman. As showing what may be done by an able man let me allude in passing to a school in Govan. This was a beneficed school supported by a large glebe set apart for grazing. The schoolmaster drew a comparatively small salary, and some few children had free education. By a short Private Act of Parliament which permitted the glebe to be feued for building purposes to a rising population, the salary of the schoolmaster became an exceedingly handsome one, and the usefulness of the school was increased twenty-fold. It is now absorbed in the Govan Board. In Hamilton there was at one time an excellent Grammar School, but it was for the favoured few. If a man wanted a leg or an arm and yet had anything of an education, he might earn a livelihood by becoming a country schoolmaster. In Bothwell there was a very good all round man named Allan, but in this it was very much better off than most parishes. A little later the Free Church planted a good school in Uddingston, and not to be outdone the Auld Kirk did the same, so that as regards education the parish was well served. In Bothwell proper, the fees were one shilling per month. These could be paid either in cash or in kind. Farmers in the vicinity let their fields to the people at the rate of 6d. per fall for the growing of potatoes. The farmer wrought the ground, the renter seeded it, manured it, cleaned it, and lifted the crop, and the farmer carted it home. If a parent could not afford to pay the 3d. per week to the schoolmaster, the pupil gathered as much horse dung as manured so many falls and got rid of the fee. Were this to be the case now, it might be easier to find the cash, but different times different ways. There was a continuous stream of carts passing through Bothwell travelling to and from Glasgow. Mining had not begun nearer the city, and the coal and ironstone from further afield all passed through the little village. It was usual for contractors, and they were many, to have 32 carts going. The horses went to Glasgow on three days, and to Lesmahagow on two days of each week. The roads were littered with the desired manure, and he was a lazy boy whose father was compelled to pay much money for his "eddication" if he were not so inclined. The schoolmaster had often more crop than he had need for, but the sale of it amply made up for the loss of the fees.

A birth in a small village was an event of some importance. If a stranger could have been transported into a southern, or a south-western village in the thirties, he might have seen the women in black gowns, and caps and aprons of spotless white, and probably he would have gone home impressed with the general tidiness of its femininity, but if he had been of an enquiring turn of mind he would have found that a son had come into the "but-and-ben" of John Robison, and that the caps and aprons were paying visits of congratulation, to say nothing of the curiosity inherent in the matronly mind when such events are on the cards. To have gone in any other garb would have been considered an insult and might have given rise to resentment.

When not at school the boys played rounders or shinty, and the girls amused themselves with the ropes or "pal-al," the modern peevoral or peevor, while for everybody there was the daily excitement of the passing of the stage-coach, or the outgoing or incoming of His Majesty's mail. It is said that at Kinross on the north road the town turned out en masse to see the day mail.

In the neighbourhood of Glasgow the women "purled," that is sewed patterns on (usually) black net, which was made up into fancy bordered veils. Purling was almost as moneymaking a trade as weaving "Harnish" at Paisley, and like it, it died out suddenly.

The women of the rural districts were very homely in their garb. The pedlar was a well-known and welcome visitor. Most of these men travelled the country either on foot or in their own gigs, and their customers were supplied from the stock they carried. In the south the men crossed the Border, and were known then as now, as "Scotch Drapers." In the beginning of the century it is said there were some 10,000 Scotchmen going up and down England on horse-back peddling cloth and other goods. Every village had its menage—sometimes two or three. There were usually twenty subscribers—a sum was named—one, two or three pounds. During twenty-one weeks each subscriber paid $\frac{1}{20}$th of the amount. Lots were drawn for places in the order of supply, and the twenty-first payment went to the (generally) woman who engineered the menage, and who had to take the risk of non-payment and make up any deficiency. Occasionally the woman was only the agent of some Glasgow house. She then worked for a commission and was freed from risk. The women made their own clothes and went mostly bareheaded except on Sundays. The men were better dressed. For them the tailor was required. My father is full of interesting reminiscences of working in the farm-houses in our decade. There were generally two or three men and an apprentice. They went to the farm on a Monday morning and there was usually a full week's work, except after a death. At such times five men went, and did the work in one or two days. The tailors had a good time. Whoever might lack, they were well catered for and comfortably put up. No one could give a house a good name or a bad one easier than the little band of tradesmen who did their work on the system known as " Whuppin' the Cat."

I find in the " Picture of Scotland "—both editions—1834 and 1840, that the clothing of the men from the Pentlands to the Solway was almost the same. A visitor to Inverness and the Morays in 1831 says, they wore homespun blue coats, rig and fur stockings, drab breeches, blue bonnets, and a plaid, and the men of Selkirk, the Galloways and Dumfries in 1832 are described as wearing the short blue coat of the country people, gamashes on the legs, a flat cap, and a plaid. In the thirties early marriage was the rule rather than the exception. " Coortin' " was of the same type as most men's before or since, but there were not those facilities for an exchange of sentiment which obtained later on. This was probably more pleasing to the girls who,

" Liked it best by word o' mou,
In oor kailyaird."

and who exacted and received more personal attention than now. John and Jenny walked together, as did Tam and Mary, and no matter what the function might be, the pairing was rigidly adhered to. Like Virginia, it was—" She's mine and I will have her." On the day when the young people were to be made one, the "best-maid" was in attendance on the bride all the time, and the "best-man" took charge of the groom. The hour having arrived the bride was "fushin" by her attendants to a spot agreed on, and there she found the male members of the party. On her way to the rendevous, and thence to the manse, the bride's nerves were tried by the discharge of all kinds of firearms, in the most unexpected places, and her firmness under the circumstances, was held to betoken a similar fortitude in certain events which might, or might not happen in the future. Marriages were usually celebrated in the manse kitchen. Having shaken hands with the minister and left a "bit present" the party made for home, and all but two proceeded leisurely. Before leaving his new home to meet the bride, the groom had placed on the kitchen table a bottle of whisky and a wine-glass. To obtain possession of these, was the reason why two of the members of the bridal party were in a hurry. Once on the door step of the manse, each man was free to make the best of his way to that kitchen table, and the incident was known as,—"Rinnin' a Braise." The man who got there first claimed the right of being bottle-holder, and walked back to meet the others whom he treated to a "tastin." When the house was a mile or two away, "rinnin' a braise" was a test of training and stamina, and many a young fellow, with a view to the event, did a little bit of sprinting on his own account, in the gloaming, of which few if any were aware. It sometimes chanced that there was a dead heat, and compromise was made, one took the bottle, the other the glass, but a yard in front entitled to complete possession. The party did not proceed to the house, but to some inn, where jollification and dancing were kept up till a late hour next morning. Marriages were generally celebrated on Fridays, and on Saturdays there was the "backin the waddin'." This was a trip to the nearest town; in the district I speak of, Glasgow or Hamilton. The young couple were accompanied by their best man and best maid, who also went with them to the "Kirkin'" on Sunday, and on Monday John began to work at his loom, and Jenny started her purlin' or her stocking. The marriage I have sketched was a regular marriage. Unfortunately there were other kinds of marriages. Up till 1826 when they were prohibited by the church, Portpatrick marriages were not uncommon. The regulations regarding marriages in Ireland were so peculiar, that many Irish people crossed over to Scotland, and were married in the Parish Kirk at Portpatrick. Others than the

Irish took advantage of its facilities. Thirteen Scottish noblemen were married there. On payment of one guinea the session-clerk walked into the church and proclaimed the banns for the pair who presented themselves. A further payment of £10 was then made, and the clergyman, who had been warned, and who was by this time in his vestry, appeared in full canonical garb, and performed the ceremony with greater or less despatch, according to the advice of a watcher who was posted outside. In the thirties the "Ower bogie" of "Half mark" marriages at Gretna were in full swing, and Elliot the great Border blacksmith priest up till 1839 had united no fewer than 7,744 hasty couples as evidenced by his certificates.

Having spoken of birth and marriage, I may as well make passing remark on death and burial. After a man died there was a "sittin' up," that is his friends gathered to the house and waited with the family. There was not the whisky and et cæteras of the Irish wake, but it was not much removed from it in its idea. The body was usually coffined the following day. At the coffining the minister was not present but an elder, who conducted a short religious service. Invitations to the funeral were passed round by word of mouth, and when the party met there was always served a glass of wine and a biscuit. The session-clerk kept a variety of mort-cloths and these were hired out. Prices ranged from a few shillings to as much as a guinea. Every funeral had a mort-cloth and persons who could not afford to pay for one, had the use of one free. The coffin was carried on spokes, at which, if the graveyard (they were not "cemeteries" then) were at any distance, the mourners took turns. An old friend, lately deceased, and who lived on Loch Lomond side, told me some years ago that in his district, mourners always wore cloaks, and when the folks saw the "Camlet cloaks comin' ower the shouther o' the Ben, they aye kent there was a funeral on the way." Graveyards were not infrequently watched, as there was still in the north an uneasy feeling that the Resurrectionists were not quite stamped out, and that opportunity might prove too great a temptation for those who were so inclined. Burking was also a bogie though its originators had been brought to book.

In these days of offering oneself for service either in the Regular Army or in the Volunteers we are apt to forget that conscription in a modified sense, still exists. The Government retains the power to call us out for home defence. In the thirties each parish was required to contribute a given number of men to the Militia, and those were selected by ballot. In order to save serving, the men paid a small weekly contribution into a society. If one of the members were drawn it was open to him to provide a substitute. Usually a few pounds sufficed for this, but a friend tells me he has known premiums to mount up as high as £20. Being the sole support of a widowed mother, or having three children dependent on his exertions, freed a man from the ballot. When Dr Colville and I interviewed the friend of whom I have already spoken, the subject of the Militia was touched upon, and incidentally a bit of curious information came out. He told us that in his boyhood days the gentlemen of Dumfries engaged in Falconry, and we heard of the "Hoodie Falklans" with their bells and jesses, as if the time had been centuries ago. The officers of the Militia and the Fencibles engaged in the sport, and the quarry was generally "grun game."

"Trade" in the small towns was not a very exciting occupation, but folk managed to make ends meet and something more. Shopkeeping was different from our modern methods. There were not stationers, haberdashers, hardware dealers, etc., but the merchant catered for all, and dealt in everything. In Galashiels the shop of a Mr Turnbull is described as having red herrings, Bibles, treacle, parasols, and ready-made coffins all check by jowl. To test the stock a visitor is said to have asked for a pair of handcuffs. The enterprising tradesman was rather taken aback, but he rummaged in a drawer, then turned to his customer and politely told him he was sorry, but he had just sold his last pair, and his new stock, though ordered from Edinburgh, would not arrive for a day or two. Trading got a severe set back in 1837 through the strikes of the cotton-spinners and the miners. The distress in the rural districts was so great that robbery was frequent and murder by no means rare.

In the towns intimation of coming events was made by the bellman, who was selected by reason of his lung power, and if, with this, he could combine a touch of wit so much the better. My friend, Mr Wallace, in his "Traditions of Glasgow," gives an account of a city bellman who flourished before the time we are dealing with, and who was quite a literary character in his own way. Fruit growing occupied the energies of many people, and a lot of money was invested in the business. The orchard district of the upper ward of Lanark was celebrated for its quantity and quality.

The trade was at its best in the thirties, and one orchard is credited with having sold its fruit growing, for £800, the buyer pulling and packing. Afterwards it fell away, but prosperity has once more come back to it. In Prestonpans, Cockenzie, and thereabouts, there were the Salters. Salt making was a profitable business. The product was in good demand—specially—"Sunday Salt." The fires could not be put out on Saturdays, and the pans had to be filled, but they took double time to evaporate, on account of the low temperature. In Edinburgh the better classes paid fancy prices for the Sunday crystals. They were considered to be better flavoured, and took an exceptional degree of fineness when rolled or beaten. Then, as now, the coast folk lived mostly by deep sea fishing, and salmon fishing employed many. In 1834 the fishing of the Dee was almost, if not quite, as valuable as that of the Tay, £8,000 worth of the fish being landed. Galloway and the Stewartry lived by the cattle and sheep trade, keeping true to the saying "Galloway for woo."

In the cities, public sanitation had become a necessity, but in villages there was none, and many small towns had hardly considered it. The Cholera of 1832 startled them. A visitor to the northern Highlands in 1833 describes them as magnificent scenery and bad roads. He speaks of Inverness as a fairly clean town. But it had not been so for very long. I do not know if the old cry of "Gardy-loo" had ever been heard there, but it is on record that when the magistrates resolved on scavenging, they wanted ten men, and they could not get one. At last one very poor man was approached, not to *throw*, but to *scrape* the first stone. With tears in his eyes he asked what he had done or his faither, or his granfaither, that their honours should seek to put this indignity on him.

The people of the North were intensely superstitious, and a belief in sorcery was still extant. In 1831 a man was tried for assaulting a woman by cutting her with a sharp stone on the forehead. His defence was that the woman was a witch, and that he had "scored her broo to draw bluid" and so avert skaith. In 1845, a girl at Louisburgh, Wick, was suspected and accused of the practices, and she was hung up in a basket over a pile of lighted shavings, so that the power to harm might be driven out of her. Even in 1867 a gentleman interviewed a witch doctor in Ross-shire, and Rogers gives a full account of his methods in his "Social Life in Scotland."

Before touching on my last topic—the kirk—let me allude to one important feature of our decade, and which affected the whole country. This was the amelioration in the laws regarding Capital Punishment. In 1832 Parliament became less timid over the reduction in the number of capital crimes, and in 1837 there were only seven, while the criminal who, up till then, had been allowed one day's grace after sentence, was granted a more extended period. In 1834, beheading, dissecting, or hanging criminals in chains were abolished, and the privilege of the Scottish counsel of addressing the jury on behalf of the client who was on trial for felony, was extended to England and Ireland. The effect of these more humane concessions was instantly apparent, for whereas in 1834 there were 480 death sentences, in 1838 there were only 116, and the 894 banishments of the former year had dropped to 266 in the latter.

And now, gentlemen, but one thing more. In the rural districts of our country the relations between pastor and people had always been of the most friendly and intimate character. The parson for the country folk was guide, philosopher, and friend. Altering one word "Edgar Nesbit's" lines apply:—

> "In sickness, tribulation, want or fear,
> First to the Parson all the people went,
> Certain to find a welcome, and to be
> Helped in the hour of their extremity."

He was a frequent visitor to their homes, and he knew almost their inmost thoughts. On one point he was not loved. His grace at table often ran into a prayer, and the hungry diner sometimes wished him far enough. A suggestion was sarcastically made that grace should be said over every carcase, so that it might afterwards be dispensed with. The country churches were uninviting and uncomfortable. "Barn like in their appearance, with clay floors, rough plastered walls, patched and grimy with dust. Small windows (ornamented here and there with deserted spiders' webs) through which the sunlight but faintly illuminated the faces of the staid worshippers; hard, bare, narrow seats, book-boards decorated with whittling and initials, and slender tin sconces projecting like drawn swords." Such is the description given by Rogers, and the photographs and sketches of such of those as are still left, amply verify it. Service began at noon and lasted a good two hours. The singing was slow, and therefore religious. A friend of mine visiting an old aunt in the country, was asked to lead the praise at family worship. He did so in modern style. When it was over the old lady said, "That's vera nice, Rubbert, but we'll noo praise God" and she led off in the style of her youth. Only the psalms were permitted. Paraphrases smacked of Popery. Dr Russell, in his "Yarrow," says he well remembers when a young man, giving out a paraphrase, and many of the people deliberately took off their specs, closed their psalm books, and remained silent. In 1831 dogs went to church with their masters. If they behaved well it was all right enough, but such incidentals as "a bit snarl and a fecht" could not be prevented, and then there was pandemonium. Sermons seldom lasted a shorter time than an hour. They were preached—not read. Reading was discreditable, and many interesting stories are told of the tricks of the speakers to hide extended notes or MS. One about Mr Pate of Innerleithen I find in many volumes.

Every parish had its Fast Day, and at the period of which I speak it was a day of strict religious observance. At the Communion, on the following Sunday, the whole parish turned out. There were four or five tables, and the preceding services were mostly conducted outside. The farmers' carts were all drawn up in a semi-circle, and the people in their best clothes sat in them. The public-houses were open, and did good business; but the days of Burns' Holy Fair had passed away. It was quite permissible and orthodox to partake of a refreshment. My old friend, on whose reminiscences I have so largely drawn, tells me that, on one occasion, at the Bothwell Communion, the parson noticed a young fellow evidently trying to coax a girl away from the kirkyard. He left his pulpit, and, coming over, he asked in a voice of thunder, "What for he sought to take the lassie oot o' reach o' hearin' the Word o' God?" to which the reply was: "She's been here a' day, sir, an' I thocht she'd be the better o' her buns an' yill." Monday, as in later times, was Thanksgiving Day.

In the early thirties the Synods were not particularly well attended. There was seldom any business of much importance, but those who did attend, renewed acquaintance and spent an evening or two in social enjoyment. One might hardly have thought it, but the clergy were very fond of a rubber at whist; and on one occasion of a Synod meeting, so intent were they of an evening, that Dr Douglas, of Galashiels, said, "Gentlemen, hold up your hands till grace be said for supper." In the later thirties there was better attendance—there was trouble in the air—the shadow of the Disruption loomed darkly on the horizon. It is not my intention to deal, in any way, with the Disruption, but I am certain we are all agreed that the abolition of Patronage—the sore which ultimately brought about the great cleavage in the Scottish Kirk—was a step in the right direction. The parish minister could hardly fail to be, in some measure, subservient to the man who had placed him where he was. The indiscreet patron sometimes interfered rashly, unmindful of the proverb; and it is recorded that the very length of the sermon was often a matter of arrangement. In the Ettrick Parish the Laird of Stirchen told the parson, " When Lord Napier or I am here you must be moderate in length; when not, you can suit your own convenience." Such words to a man of spirit could not fail to be galling, and doubtless often provoked an active antagonism. The Disruption did not come till the next decade, but it was fought in the thirties, and whether we sympathise with them or not, we cannot but admire the men who, in the words of an eminent Roman Catholic dignitary, now deceased, " made, for conscience sake, the greatest sacrifice ever known in Ecclesiastical History."

Gentlemen, I have done; I fear I have been too long, but my trouble has been to keep even to this length. Many of the matters I have alluded to are worthy of a separate paper. Do we live in better times? I think it cannot be a question of debate; and, therefore, let us not forget our forefathers who fought for, and who gained for us the blessings we enjoy, and let us try our best so to live, that we may be worthy sons of worthy sires.

XVII.—*Note on Additional Experiments with the Electric Sonometer.* By Professor JAMES BLYTH, M.A., LL.D.

[Read before the Mathematical and Physical Section, 23rd April, 1902.]

THE electric Sonometer is the name given to an instrument whereby a stretched wire can be maintained in vibration by means of a periodic force of known amount being applied at a given point of the wire. It consists of an ordinary monochord, with the wire stretched between two fixed terminals, and having an adjustable bridge whereby the vibrating length of the wire can be altered so as to get a note of definite frequency. This wire is placed in circuit with a battery and a tuning fork interruptor, and in this way a periodically intermittent current is sent through it. Astride the wire, and at a given distance from a fixed end, is placed an electromagnet, or a strong permanent magnet, so that the wire at that point is in a strong magnet field whose lines of force are perpendicular to it. In this way whenever the current passes, the wire is acted upon by a mechanical force whose value per unit of length is equal to the product of the current and the strength of the magnetic field, and by this force the vibration of the wire is maintained. If the length of the wire be adjusted till its natural frequency is the same as that of the fork, the amplitude becomes very great, and the wire sounds out loudly.

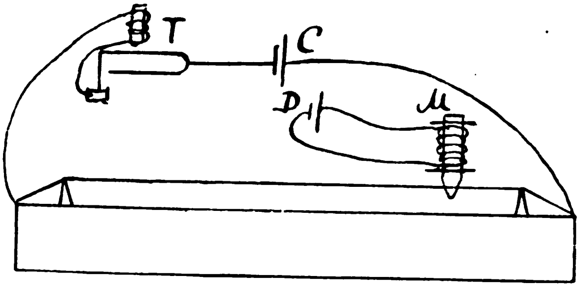


FIG. 1.

The whole arrangement will be understood from Fig. 1. where T is the tuning fork, and M the electromagnet, C and D being the batteries which supply current to the wire and electromagnet respectively.

A description, essentially the same as the above, of the instrument was given in a paper which I contributed to the Royal Society of Edinburgh several years ago.

I have lately had occasion to resume experimenting with the instrument, and have found that it can be used so as to show very distinctly the effect of adding a little self-induction to the circuit containing the vibrating wire and fork. For this purpose a graduated scale is placed in front of the middle point of the vibrating length of wire, and an image of both is thrown upon a screen by an obvious magic-lantern arrangement. In this way the amplitude of the wire can be measured, and any change in it observed with fair accuracy. When a coil wound non-inductively is placed in the circuit, the full amplitude is attained when the wire and fork are adjusted to unison; but if a coil of the same resistance, but having self-induction is inserted, the amplitude immediately decreases and the effect of a very slight alteration in the amount of self-induction added (such as by inserting a rod of iron into the coil) is easily observed. As will be obvious, the instrument may be used very effectively to give a class illustration of the difference of impedance of two circuits, and also to find out very approximately the frequency of an alternate current, provided it be great enough to set the wire in vibration in its fundamental mode.

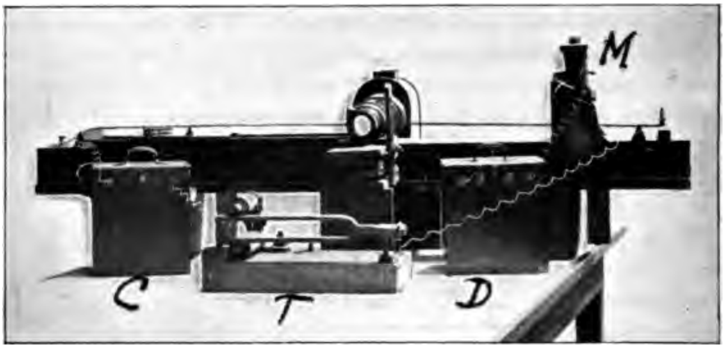


FIG. 2.

The whole arrangement is shown in Fig. 2 which is reproduced from a photograph of the apparatus *in situ*, kindly taken for me by Mr James Alexander. I have also to thank Mr Scobbie for valuable assistance in getting the experiments to succeed.

XVIII.—*Early Alliterative Verse.* By JOHN CLARK, M.A., Hon. Secy., Historical and Philological Section.

[Read before the Historical and Philological Section, 14th April, 1902.]

THIS paper is a mere preliminary statement of the results of textual investigations as yet far from complete. The object of these is to show the true position of alliteration in the evolution of verse, and if possible to prove, that the origin and natural beginnings of poetry are to be sought in that metre that Layamon and Langland loved so well—in that measure so dear to the heart of many a northern bard, including Dunbar and Gawain Douglas, and that new star whose full magnitude has just been discovered—Huchown of the Awle Ryale. At present we shall deal only with the Teutonic languages on the one hand, and with Latin and the Italic dialects on the other.

Now all poetry must have either a temporal or an accentual standard, and when we examine the literatures of the Indo-European family, to which these languages belong, we find that only three, Sanscrit, Greek, and Latin determine the rhythmical time by the natural quantity of sound. All the rest, including the modern representatives of these three, determine their rhythm by accent without explicit reference to natural quantity. This "desertion," if we may so call it, by the Romance languages, of the classical standards, has a most important bearing on the present inquiry. Various hypotheses have been put forward to account for it, but the problem has commonly been regarded as one of great, if not insoluble difficulty. Suggestions as to its solution have taken three main directions :—[1]

(1) That accent as an index of rhythm may have been borrowed from the northern invaders.

(2) That it may have arisen from loss of inflexion.

(3) That it may have been a revival of a vulgar rhythm until then kept in check by more fashionable metres.

---

[1] cf. Guest : *History of English Rhythms*, p. 2.

Borrowing, in the ordinary sense, we may set aside. Phonetic decay undoubtedly did play a part in the history of rhythm, but the last theory, that of revival, appears to contain the kernel of the whole matter, and my case is that the "desertion" was in the main a reversion to a former type, common in pre-classical days, and that this type was very similar to, if not altogether identical with, the Teutonic. My contention, further is that the evolution of the classical from this original type, and of the Romance from the classical is not only explicable, but absolutely natural.

The first question we have to answer is: "What was this Teutonic type?" We must begin with a working definition, and in submitting such a definition it is my desire in the strongest possible terms, to emphasise the fact that whatever we are to lay down as the general rules followed by this type, that is the alliterative type, we must for our present purpose keep two important points in view:—Our rules must, in the first place, apply to the essentials of the whole body of Teutonic poetry, north, east, and west, and, in the second place, to the whole period embraced by the various units of that poetry. The subject must be approached from the texts themselves, and with the greatest caution, for the most astounding statements have been made regarding the nature of this metrical structure—and made by scholars of world-wide reputation, by men like Hickes, Thorpe, Turner, and Tyrwhitt, and many more modern critics. For the former we can offer some excuse in view of their defective texts, and the unparalleled difficulties under which they laboured. But what shall we say of the latter? Finding the imprimatur of such scholarly approval upon certain opinions, they have gone on patching and tinkering at old ideas, instead of making a new and more rational beginning. Better texts and more efficient critical apparatus have revealed many exceptions to so-called rules, but critics have been too ready to take up the position that the text requires emendation rather than that the rule requires re-adjustment. In this way, for example, before the publication of the *Corpus Poeticum Boreale*, the whole Icelandic Dialogue metre, was twisted and mutilated to make it conform to a hypothetical standard. What spoiled these earlier, and many later, critics was their classical prejudice. They had been trained in a classical school, and their ears had been attuned to classic measures, and therefore by the most drastic of Procrustean methods they endeavoured to reduce everything to a classical standard. Like the exponents of the Ptolemaic system they dreamed they stood upon a fixed and solid earth, and swore the sun went round.

To such a length did this prejudice go that we find Hickes[1] asserting and endeavouring to prove in the face of the texts themselves that the Anglo-Saxon poets must have observed, and did actually observe, the rules of Latin prosody and the laws of syllabic quantity, while on the other hand Tyrwhitt, in 1847, either from an ignorance that can only be designated "colossal," or from that inherent proneness in the human race—due, no doubt, to original sin—to state a counter proposition in the strongest and most dogmatic manner, explicitly declares himself "unable to discover any material distinction of the Saxon Poetry from Prose, except a greater pomp of diction, and a more stately kind of march." He does admit, however, "that the Saxons had a species of writing, which differed from their common prose, and was considered *by themselves* (the italics are mine) as poetry," but he can not see "any marks of studied alliteration in the old Saxon poetry."[2] These are the extreme limits of the disagreement of the critics! Tyrwhitt's position is absolutely unpardonable, for already in 1826 Conybeare,[3] and in 1830 Rask had grasped the fundamental principles of the Teutonic metrical system. The former, in particular, gets at the root of the matter, and reaches a conclusion which his successors would have done well to profit by, when he says: "I suspect that the matter lies completely on the surface, and that the good barbarians were content if their verse had rhythm enough to be sung and alliteration enough to strike the ear at once. . . . The ear is satisfied, not by the number of syllables, but by the recurrence of accent."[3] Modern critics have not improved upon that "suspicion." Indeed, they have disregarded it, and though the texts themselves have proved it to be no mere "suspicion" but an absolute fact, they have gone on laying down rigid rules regarding alliteration. Thus Rask[4] states there should be three alliterations in the line, and implies that the presence of only two is an uncommon occurrence. Others, after Rask, have not even made this reservation. For example, Professor Morley, in 1888, lays down this rule: "The three first of the four accented words, two in the first half-line, and one in the second, were alliterated, and the letter of alliteration in the second line was looked upon as the chief letter."[1] In Traill's *Social England*,[2] the writer on this subject is equally definite on the consonantal alliteration, and goes on to say that, when the alliteration consists of "spiritus lenis," or smooth breaking, the rule requires that each of the three syllables in the line should commence with a new vowel. Professor Skeat's[3] pronouncement is in similar terms, but he calls attention to a considerable number of "exceptions." Among those who take up a more accurate position are Dr Sweet[4] who, however, seems to make too much of quantity; and Dr Schipper, whose *Englische Metrik* is full of interesting details.[5]

---

[1] cf. *Thesaurus Ling. Sept.*, Vol. I., ch. xxi., especially p. 181.

[2] Tyrwhitt's *Chaucer*, Introd. xxix. and f.n.

[3] Conybeare *Illustrations of A.S. Poetry.* Introd. p. xv.

[4] cf. *A.S. Gram.*, p. 136.

Let us test this alleged norm of three alliterations by the texts we are to consider. Disregarding, for the time being, the early fragments which give us no information as to the proportion of threes to twos, and allowing three alliterations wherever there is any claim to even a doubtful accent, we have the following results:—

In the *Traveller's Song*,[6] despite the number of proper names beginning with the same letter, only seventy-one lines out of a hundred and forty-three have three alliterations. The *Charm against Bewitched Land* gives but ten threes in thirty-seven lines; that against a *Sudden Stitch* gives six out of twenty-three; the *Bee-Charm* gives two out of eight; the *Waldhere* fragment, twenty-five out of fifty-eight; *Finsburg*, eighteen out of forty-five; while even a "bookish" poem like the *Elene* gives only forty-six per cent of threes. The *Beowulf*, however, gives five hundred and four threes out of the first thousand lines, while the *Wanderer* gives sixty-nine per cent of threes, and the *Seafarer*, sixty-four, a result by no means astonishing in view of the number of very long lines. Of the later poetry, *Brunanburg* has a hundred and fifty-seven threes out of three hundred and twenty-four complete lines. In *Alfred's Death* twelve lines have two alliterations, five have three, and three have none. Similarly in *Edward's Death* we find thirteen threes, nineteen twos, and two lines with no alliteration. In only one piece in the whole range of Anglo-Saxon poetry are three alliterations to be found in every line, and that is in the *Rime-Song*, the very last place we should look for such a result.

---

[1] *English Writers*, II. 19. [2] Vol. II. p. 188.

[3] *Percy Folio MS.* Vol. III., Introd. xi.-xxviii.

[4] *A.S. Reader* (7th ed.). Introd. lxxxv.-xcvi.

[5] Especially pp. 39-121. Vol. I.

[6] The Text in every case is the "Grein-Wülker."

In the German poetry, *Hildebrand and Hadubrand*, in the lines examined, gives thirty-six per cent of threes; the sixteen line *Wessobrun Prayer* with difficulty gives eight threes; *Muspilli*, in so far as tested, shows only thirty per cent of threes, and in the *Heliand* the percentage is distinctly in favour of twos.

The Icelandic poetry, the last refuge of early alliterative verse, gives even a more definite answer to our tests. The *Song of Saws* shows nineteen threes out of fifty; the *Hava-mal*, sixteen out of a hundred and thirty-five; the *Spell Song*, eight out of thirty-four, and the *Old Play of the Wolsungs* gives two hundred and seventy-seven twos, forty-two threes, and one four.

In the face of such evidence, the alleged rule of three alliterations must be abandoned, and all we can claim for Teutonic poetry, as a whole, is :—

(1) That each line is, in general, a blank verse—middle rhyme, however, being not unusual, and even end rhyme occasional.

(2) That each line is divided into two parts by a caesura or line pause which *always* comes at the end of a word.

(3) That each verse may be regarded as made up of a number of "measures"[1]—usually four (except in the Dialogue metre which has commonly three).

(4) That each "measure" contains a stressed syllable, and that of these stressed syllables at least two and rarely more than three begin with the same consonant, or with *a*[2] vowel.

But not only must we reject the norm of three alliterations; we must also be prepared to admit the greatest variety—shall we call it irregularity?—in the "fall" of the syllables bearing alliterative stress. For three, the usual arrangement is two in the first half-line, and one in the second; for two, one in each half-line. But a further examination of the texts reveals that this distribution of alliterating syllables was far from rigidly observed. Almost every possible arrangement is to be found, and found, as the following rough chronological survey will show, at every stage in the development of this metrical system.

---

[1] The word "measure" must of course be taken in the widest sense to include either a word or a group of words.

[2] When vowels alliterate, they are generally different vowels.

The oldest Teutonic literature that has come down to us dates back to the fourth century of the Christian era, and is prose. All the old songs have gone. Their memory still lingers in the pages of Tacitus, but the silent stream of time has made them its victims.

But while the earliest remains are prose, they have characteristics that are most valuable for our present enquiry. All through, the element of alliteration is very marked. Of course, it might be urged that "alliteration" is not "alliterative verse." That would be a very pertinent objection, and the answer would be that a study of the texts appears to prove that the literature we are considering reached the platform of poetry by fixed and definite stages from mere prose, with alliterative tendencies so strong that some would regard it as rude and irregular verse. Many *prose* elements are found in their *poetry*; much that is *poetical* is to be seen in their *prose.*

For examples, these lines of Ulfilas, arranged according to the alliterations might well be mistaken for verse :—

" So **m**anagei wairilom   **m**ik sweraith
Ith **h**airto ire fairra   **h**abaith sik mis."[1]

" **L**aisjandans **l**aiseinins   anabusnins manne."[2]

" Stains **th**ammei uswaurpan   **th**ai timrjans,
Sa **w**arth du   haubida **w**aihstins."[3]

" Unte ik galagja **f**ijands theinans   **f**otubaurd **f**otiwe theinaize."[4]

Let us next consider a few of the inscriptions left in the old Teutonic language. Their interest is, of course, mainly archæological, but they are valuable as showing the "irregularities" which the whole body of the alliterative poetry exhibits. The oldest is that on the Golden Horn, dated by Vigfusson and Powell[5] as circa 300 A.D., but probably almost a century later :—

" Ec **h**lewagastiz **h**oltingas   **h**orna tawido."

This may be compared with that on the Tune Stone, which Vigfusson[6] dates at the beginning of the fifth century :—

" Thrijoz **d**ohtriz **d**ailidun . . . z woduride st . . .
Arbijas **i**jos tez-**a**rbijand,"

and with this other of similar antiquity[5]:—

" Ec **W**iwaz after **W**oduride   **W**itai-gahlaiban **W**orohto runoz."

---

[1] *St Mark*, vii. 6. [2] Id. 7. [3] xii. 10. [4] xii. 36.

[5] *Corpus Poeticum Boreale*, I. 436. [6] *Icel. Reader*, p. 446.

The diversity is marked. The type is not fixed, and I question if it ever was.

From this point a long bridge stretches to the seventh century, for I cannot accept the suggestion that we have any existing poem prior to that date. In this century the only Old High German contribution is the *Vocabulary of St Gall*, but in Anglo-Saxon we have the *Traveller's Song*, which some critics would place as early as the fifth century. We need not dwell upon it, except to ask you to compare these lines as examples of the "regularity" of the verse:—

7. "**H**rethcyninges **h**am gesohte."
19. "**W**ulfhere sohte ic and **W**yrmhere : ful oft thær **W**ig ne alæg."

The eighth century is sometimes regarded as the golden age of Anglo-Saxon poetry. To it many poems unquestionably belong, and many hover close to its extreme limit. Every variety is to be found. We have Sagas like the *Beowulf*, poems of Elegiac cast like the *Wanderer* and the *Seafarer*, rude folk-songs like the *Charms*, Cædmonian poems like the *Dream of the Rood*, Cynewulfian poems like the *Elene* and the *Phœnix*, and other types which we have not space to consider. Old High German proves less productive. *Hildebrand and Hadubrand* and the sixteen line *Wessobrun Prayer* alone have any interest for us. Again, and in all these poems we have the same lack of a finished type. Lines of surpassing beauty in the Cædmonian and the Short Epic style are side by side with the crudest products of the literary cobber. In certain poems this may to some extent be due to the fact that much of their material is very old, and while now for the first time set down in writing is reminiscent of the gray dawn of Germanic history and the earliest phases of Teutonic thought. This is notably true of the *Beowulf* and of the *Charms*, but it by no means explains all that we find. In the latter we have already seen their extreme fondness for two alliterations. But they occasionally attain at least to four—if not to five. Some reach the minimum limit of length as:—

"**G**armund **g**odes thegen."[1]

Into some, the poet seems to crowd the alliterative letters he has omitted elsewhere.[2] We have quickstep lines like:—

"Find thæt **f**eo and **f**ere thæt **f**eo,"[3] in the same poem with such a heavy-footed prosy verse as:—

---

[1] *Lost Cattle*, l. 6.

[2] cf *Bewitched Land*, l. 77. "Se **g**od se thas **g**rundas geworhte geunne us **g**rowende **g**ife."

[3] *Lost Cattle*, l. 7.

"Binnum thrym nihtum cunne ie his **m**ihta,   his **m**ægen and [his **m**ihta and] his **m**undcræftas,"[1]

which was surely long enough and dull enough without the scribal error it evidently contains. We have different alliterations in each half-line as in the verses:—

"Ofer the **b**ryde **b**yro dedon,   ofer the **f**earras **f**nærdon."[2]
"Syx smithas **s**ætan   **W**ælsper **W**orhtan."[3]

We have mechanically accurate lines of no poetic beauty like:—

"**F**ul æcer **f**odres   **f**ira cinne."[4]

We find a long initial slur as in:—

"Thæt ne sy nan to thæs **c**widol wif   ne to thæs **c**ræftig man,"[5]

and a musical interlacing of alliteration as in:—

"**S**tod under **l**inde   under **l**eohtum **s**cylde."[6]

We even find the poet with a hopeless sense of his own ineptitude reverting to mere prose, but retaining a form of stressed alliteration.[7] In short, we find everything except regularity. It may be urged that these are extreme cases. Undoubtedly they are, but even in the *Beowulf* we find such an atrocity as

"Beforan **b**eorn **b**eran   **B**eowulf gethah,"[8]

alongside of the well-balanced

"**M**ære **m**aththumsweord   **m**anige gesawon,"[9]

or of this long line with its two alliterations,

"Ac he hafath on**f**unden   thæt he tha **f**æhthe ne thearf?"[10]

In the *Wanderer*, fine stately lines like:—

"**S**wa cwæth **s**notor on mode   ge**s**æt him **s**undor at rune,"[11]

are thrown into bold relief by the dark prosy background of such verses as:—

"**T**il bith se the his **t**reowe gehealdeth: ne sceal næfre his **t**orn to rycene."[12]

But we need not multiply instances. They are so numerous that one cannot read a page without stumbling on them. In the Old High German branch it is the same. For example, the opening line of the *Wessobrun Prayer* is in good Cædmonian style; the tenth is pure prose and is printed as such by Wackernagel.[1] Similarly a comparison of these four lines of *Hildebrand and Hadubrand*, gives an interesting variety:—

---

[1] *Lost Cattle*, 14.
[2] *Nine Herbs*, l. 10.
[3] *Sudden Stitch*, l. 16.
[4] *Bewitched Land*, l. 73.
[5] Id. 64.
[6] *Nine Herbs*, l. 8.
[7] cf. *Nine Herbs*, ll. 47-57.
[8] l. 1024.
[9] l 1023.
[10] l. 595.
[11] l. 111.
[12] l. 64.

4. "**G**aratun se iro **g**udhamum   **g**urtum sih iro suert ana."
20. "Prut in **b**ure   **b**arn unwahsan."
29. "Wehi **I**rmingot, quad **H**iltibraht   **o**bana ab **h**euane."
44. "**D**at du noh bi **d**esemo   **r**iche **r**eccheo ni wurti."

With regard to the prose of this century it is only necessary to say that the *Benedictine Rules*[2] of Kero, of St Gall, (cir. 760) shows the same tendency to the grouping of words with alliterative stress as we find earlier in Ulfilas and one or two centuries later in the Icelandic Laws.[3]

Till the ninth century, the northern muse is silent. The "hoary antiquity" of the Eddic poems is a myth. Accretions they do have dating back into the mists of time, but in their present form even the oldest of them must be located here. As the editors of the *Corpus Poeticum Boreale* have pointed out,[4] the changes that the tongue of the Northern Teutons underwent in the eighth century makes an earlier date impossible. The pieces that we have most minutely examined—the *Song of Saws*, the *Hava-mal*, the *Spell Song*, the *Old Play of the Wolfsungs*, and the *Old Lay of Atli*,—are among the oldest extant remains and almost certainly fall within this century.

Here again are the identical "irregularities" we have already considered. Take the first three Dialogue lines of the *Hava-mal:*—

2. "**U**rthar brunni **a**t."
4. "Hlydda-ek a **m**anna **m**al."
6. "**H**ava-**h**aollo **a**t."

Each line has its three beats or measures; they have nothing else in common. We find the same in the first three Cædmonian lines:—

1. "Mal es at **th**ylja   **th**ular-stoli a."
3. "Sa-ek thagthak;   **sa**-ek ok hugthak."
5. "Of **r**unar heyrtha-ek dœma   ne um **r**aothom thaogtho."

Observe that these two groups give six consecutive lines, and you will at once see the extent of the variety.[1] In the *Spell Song* also we find such striking contrasts in respect of length, as:—

---

[1] l 1. "Dat gaf**r**egin ih mit **f**irahin   **f**irwizzo meista."
l. 10. "Cot almahtico du **h**imil   **e**nti **e**rda gawarahtos."

[2] cf. "**k**eaukenti **k**elaubigan," "so **s**caf dera **s**lahta," etc.

[3] cf. "Sem **m**etendr **m**ato," "ok **t**eljendr **t**öltho," "ok **d**omr **d**œmthi," etc. *C.P.B.* I. 438.

[4] cf. *C.P.B.* I. Introd. lvii.

1. "**Th**ær of **r**eth, **th**ær of **r**eist."
10. "A **S**kildi kvath ristnar, theim-es **s**tendr fyrir **s**kinanda gothi."[2]

In Old High German we have examined the *Muspilli*, Otfried's *Krist*—the latter notable as being the first Teutonic poem using rime—and the *Heliand*, really an Old Saxon poem. These may be dismissed in a few words. In *Muspilli*, the line

"Daz hort ih **r**ahton dia weralt**re**htwison,"

if the text is correct, shows the unique spectacle of an alliterative syllable in the middle of a word, and of the three lines which follow, the first has two alliterations, the second has four, and the third has three. In the *Heliand*, the lines we are about to quote require no comment:—

362 "An **e**rdagum **a**thalkuningas."
363. "**D**avides thes godon, than langa the he thana **d**ruht-skepi thar."
366. "Kuman fon is **k**nosla **k**unneas godes."
367. "**B**ethiu bi gi**b**urdium. Thar gifragn ic that sie thiu **b**erhtum giskapu."

Of the *Krist*, we need only say that the oft-repeated statement that it does not at all depend upon alliteration, is entirely erroneous.[3]

With the close of the ninth century the curtain falls so far as Old High German and Anglo-Saxon are concerned. The former has nothing to show us, the latter exhibits the depths to which poetry may fall. The *Rime-Song* of the tenth century, as the name implies, marks a new departure by the introduction of middle rime. But, in addition, alliteration is so strictly observed that this poem has, as we have already said, the unique distinction of having no line which falls below the "norm" of three. That is its only recommendation. Time was ripe for change. No poetry could stand such fetters of iron. The *Chronicle* poems of this and the following century are the veriest drivel, with the single bright spot of *Brunanburg*. It has one or two marked characteristics, such as crowding its alliterating words together in the middle of the line. With two[1] there seems to be a tendency to begin with a slur and make the last word in the first half-line, and the first in the second half, alliterate; with three[2] the last two of the first alliterate with the first of the second. Interlacing of alliteration is found in such lines as :—

---

[1] cf. 53. "Vith **s**avkom ok **s**orgom ok vith **s**otlom gœrv-aollom."

[2] cf. *Wolsungs*, 147/8/9, *Atli*, 3/4, 22/3, *Song of Saws*, 26/34, and note l. 11, "**B**restanda boga **b**rennanda loga."

[3] "**Th**o warun **th**ar in lante **h**irta **h**altante."
"Thes **f**ehes datun **w**arta **w**idar **f**ianta."
"Joh **h**intarquamun **h**arto thes godes boton worto,"
may be taken as typical lines.

98. "Ofer **sc**ir **W**æter   **sc**yldas **w**egon."
255. "**D**unhere tha **cw**æth   **d**aroth a**cw**ehte."

Even here the quality is unequal,[3] but compared with the remaining *Chronicle* poems its merits are undoubtedly great. As for the others, let the dust of centuries cover them and hide them for ever !

But in the Icelandic poetry there is a different tale to tell. It was but in the beginning of its greatness. About 950, we have the *Helgi* cycle, and that grand poetical product of the north, the *Volo-Spa.* To these, for comparative purposes, we may add the prosy *Lay of Hoarbeard*, and the poetical prose of the *Flyting of Ivar and Woden*, also about the middle of the century. For variety of metre the *Helgi* poet excels all his Teutonic fellow-craftsmen. Sometimes we have five or six variations inside of ten lines.[4] In the *Hoarbeard*, poetical lines like

7. "**V**as-ek a **V**allandi   ok **v**igom fylgdak,"[5]

may be contrasted with such unmelodious verses as :—

145. "**O**k mun hon kenna honom   **a**ttunga brautir til **O**thins landa."
30. "Tha mun ek **f**ortha **f**iaorvi   mino **f**yr slikom sem thu est, nema ek **f**eigr."
146. "Munek **t**aka   thangat i **d**ag?"[6]

If these lines are not prose, one may have difficulty in finding it. The last really does not alliterate. On the other hand many of the lines of *Ivar and Woden* may be set down as poetry.[7]

What has been said of the tenth century may be repeated for the eleventh. Germany is represented by Williram's *Explanation of the Songs of Solomon*, and *Merigarto*, an alleged geographical poem which is neither poetry nor prose. The Anglo-Saxon branch has been already disposed of, and it is not our purpose to consider the Icelandic "Court Poetry," with its multitude of metres. With two runic ditties, therefore, we shall close:—

---

[1] cf. ll. 35, 46, 64, 79, 80, 81, 184, 243, 249, 323.

[2] cf. 88, 97, 119, 66, 72, 141, 169, 269, 297, 303.

[3] cf., *e.g.*, l. 94, with ll. 220, 308.

[4] cf. *Helgi and Sigrun*, ll. 257-266.

[5] l. 74.

[6] cf. l. 49. "Ok or **d**ali **d**iupom   **g**rund um **g**rofo."

[7] *e.g.*, 4, "**H**er mun ek **s**tanda   ok **h**ethan **s**egja."
12. "**H**ann vas **H**ermothr   es bazt vas **h**ugathr."   cf. also l. 14.

75. " Her mun **st**anda **st**ainn nær brautu,"
78. " Skal at **m**innum **m**anna **m**ethan **m**enn lifa." [1]

With no absolute fixity of type we began, without absolute fixity we end. The same characteristics are to be found throughout. We have prose and poetry intermingling and gliding into one another, and in it all there seems to lie the germ of a great truth —nothing less than that "impassioned" or rhythmic prose was the absolute beginning of poetry. We seem to see dimly the steps of a gradual evolution, and with all the lost texts discovered, our vision would be clearer. The poetic life of a nation corresponds to the natural life of a child. In phrases with distinct emphasis on particular words, and in chanted prose with emphatic catchwords, we must seek the beginnings of Teutonic poetry, and of all poetry. There seems clear argument towards that in the irregularities we have been considering, or are about to consider. Now it was a spoken literature and some mnemonic system was necessary, and the outcome was the natural application of the laws of association—the easy association of like with like. In other words, the most emphatic syllables began with the same letter. Irregular alliterative phrases gradually evolved a system of poetry, so-called, well-suited for purposes of recitation—a poetry with no *absolute* fixity or regularity, of which the only essentials were the three factors of caesura, accentual stress, and alliteration. From this, by a natural process of evolution, came a more regular line with two main varieties—the stately rhythmic Cædmonian line, with its multitude of slurs so admirably adapted for rhetorical effect, and the short hammering epic line, which differed from the other only in respect of the absence of these slurs. Both kept to the end the "irregularities" with which they began. Both had, as a rule, four beats and a rhythmic movement sufficiently pronounced to catch the ear; and we can imagine that on the threshold of history, when musical instruments were yet unknown among the Teutons, this was the low monotonous chant to which they danced. In this measure the great bulk of early Teutonic poetry was written. The only other of which we have spoken is the Icelandic Dialogue metre, with its three beats. In the poems where it occurs it is found in conjunction, often in alternation, with one or other of the two four-measured varieties.

---

[1] *C.P.B.*, I. 371.

So much for the Teutonic. Let us next see how the matter stands in Latin and the Italic dialects. Our object, as we have already stated, is to prove that we find similar, if not identical, characteristics here—in fact that all poetry originated from a single type, the alliterative. The materials for our task are defective, and many texts have yet to be discussed; but those we have examined distinctly show that such critics as Conybeare understate or even misstate the case, when they say that alliteration "never could have formed any part of the systematic prosody either of the Greeks or Latins,"[1] and that "l'accent tonique ne joue aucun rôle dans la versification antique,"[2] or that it is not until 250 A.D. that "l'accent tonique commença à jouer un rôle dans la versification latine,"[3] or that in Latin, alliteration was no more than "une elegance." The rude folk-poetry of Italy, the oldest remains of Latium, would have proved this to be utterly wrong. We must remember that Latin, as we usually know it, had come within the sphere of Greek influence, and that its poetical structure had been affected by Greek models. To see the pure Latin type of verse and cast of thought, we must go back to the very earliest poetry, and we must not be surprised if we do not always find it here, for even some of the oldest Oscan inscriptions show traces of acquaintance with Greek comedy.[4] The very name "poeta" is Greek not Latin. The poets themselves were not natives of Latium. Livius Andronicus was a slave of Greek parentage from Tarentum, and his poem was a translation from the Greek. Naevius served as a Campanian "socius" in the Punic War. Ennius was born at Rudiæ in Calabria, and directly applied Grecian models to Latin verse. The marvel is that we find so much of what was evidently the old Latin cast of thought, and that what is left is so valuable proof of the existence of *intentional* alliteration. It seems to show that Niebuhr's idea of a "golden age" in the fifth century after the foundation of the city,[5] may after all have in it a shadow of truth, and that there was a literature of some value, even before, in the words of the poet—

---

[1] *Illustrations of Anglo-Saxon Poetry*, Introd. xxxii.

[2] Plessis, *Traité de Métrique Grecque et Latine*, § 45.

[3] Id., § 45, cf. § 50.

[4] cf. Mommsen, *Hist. of Rome*, II. 495.

[5] *Lectures on Roman History* (ed. Schmitz), III. Introd. xiv.

> "Græcia capta ferum victorem cepit et artes
> Intulit agresti Latio."

But let us leave mere speculation, and study the remains that time has left us.

Beginning with the dialects of Italy,[1] we get some marvellous results. The alliterations are as marked as in the Teutonic, and exhibit the same variety of type. The first two are Oscan inscriptions from Pompeii, of date third century, B.C.—

> "Ni **t**rebiis **t**ri med **t**uv aamanaffed."
> "**M**aa **m**ieise **m**efitaiiais . . . ukin."

One at Cumæ reads—

> "Statie **s**ilie **s** . . . **s**alavs."

At Nola we have

> "Paakul **m**ulukiis **m**arai **m**eddis,"

and at Abella—

> "**M**ais vesi **m**ain terem ?"

In northern Oscan the Corfinium inscription, of which the first line runs thus—

> "Usur **p**rista falacirix **p**rismu **p**etieduip vivadu,"

has other five lines, all with identical characteristics.[2]

In Umbrian, on the breastplate of a warrior, we read—

> "Ahal trutitis **d**unum **d**ede,"[3]

and in the *Tabulae Iguvinae*,[4] cir. 400 B.C., we have, as printed by Conway, twenty-five *pages* of alliteration so distinctly marked on accentuated syllables that it must be more than "une elegance." Groups of twos and threes per line, such as,

> "**P**une **p**uplum . . . **p**ernaiaf,"
> "**P**ustnaiaf **p**une, **k**uvurtus **k**renkatrum . . . ,"
> ". . . . **t**vese **t**efe **t**ute . . . . ,"
> "**T**adinate, **T**urskum . . . ,"

are never awanting. Indeed, these *Tables* have more regular and pronounced alliteration than anything I have yet seen in Teutonic prose.

Turning now to the Latin inscriptions, we have, on a sarcophagus (cir. 234 B.C.) found at Rome, 1780, five lines referring to one of the Scipios, whose name forms a sixth line.[1] They all alliterate, and show similar variety to the Teutonic—

---

[1] cf. Conway's *Italic Dialects*, pp. 63, 75, 89, 94, 242.

[2] cf. also *Cippus Abellanus*, found at Avelli, cir. 150 B.C., where the writer certainly uses alliteration advisedly.

[3] *Italic Dialects*, 397.

[4] Id., 407-432.

"**Gn**aivod patre pro**gn**atus   fortis vir sapiensque."
"Quoius **f**orma virtutei   parisuma **f**uit."

In that found at Sora and dated by Ritschl, 150-50 B.C.,[2] we have again five lines of equally good alliteration with a tendency to two in the second half-line, such as is not uncommon in the Icelandic Dialogue metre. One line has two distinct groups—

"**D**ona **d**anunt Hercolei   **m**axsumo **m**ereto."

Another inscription[3] of date cir. 200 B.C., has six lines, all perfect alliterations, and showing four different styles of which we quote two :—

"**M**agna sapientia   **m**ultasque virtutes,"
and
"Aetate quom **p**arva   **p**osidet hoc saxsum."

Then coming to specimens of *Sortes*, we find that of the eleven given by Wordsworth,[4] *all* alliterate, and four at least have three alliterative elements :—

"**C**onrigi vix tandem   quod **c**urvom est factum (**c**)rede."
"De vero **f**alsa ne **f**iant   judice **f**also."

These *Sortes* were very old, and would naturally be archaic in style.

This brings us to the three poets we have specially examined.

In Livius Andronicus (284-204 B.C.) not more than five complete lines of the forty-eight *Ex Odissia quae supersunt omnia* do not clearly stand the test, and, as these examples show, the same variety is again apparent :—

5. "**M**eam **m**atrem **p**rocitum   **p**lurimi venerunt."
11. "Tuncque **r**emos jussit   **r**eligare struppis."
15. "**S**ancta puer **S**aturni   filia regina."
34. "Inferus an superus tibi **f**ert   deus **f**unera Ulixes."
42. "At celer hasta volans   **p**errumpit **p**ectora ferro."

Equally good results are to be found in Cneius Naevius[5] (cir. 235 B.C.) where over ninety per cent alliterate, and there is one notable case of line-rime,

"Bicorpores Gigantes   magnique Atlantes."

---

[1] Egbert, *Inscriptions*, p. 294.
[2] Id., 280.
[3] cf. Wordsworth's *Fragments*, p. 161.
[4] Id., 241-2.
[5] Wordsworth's *Fragments*, 292-9.

The following are typical examples. From his *Punic War* we may take:—

15. "Deum regis fratrem   Neptunum regnatorem."
29. "Prima incedit Cereris   Proserpina puer."
33. "Scopas atque verbenas   sagmina sumpserunt."

His *Tragedies* supply some excellent types:—

32. "Ubi bipedes volucres lino   linquant lumina."
34. "Ut in venatu   vitulantis ex suis."
39. "Die quo pacto eum potiti sitis   pugnane an dolis?"[1]

Even better are his *Comedies*:—

101. "Lares ludentes   peni pinxit bibulo."
112. "Libera lingua loquemur   ludis liberalibus."[2]

Note also the last line in his *Elogium*:—

"Obliti sunt Romæ   loquier lingua Latina."

Now what are we to say of all this? A comparison with the Teutonic reveals exactly similar characteristics, the only elements *always* present being the three factors required for alliteration. This rude, irregular verse is hard, if not impossible, to scan by classical standards. Many attempts have been made, amongst the best being those of Plessis in his *Mètrique Grecque et Latine* (pp. 42, 297), and Havet in his *De Saturno Latinorum Versu*, but I have seen no thoroughly satisfactory explanation. The old grammarians like Marius Victorinus and Atilius Fortunatianus are more nearly correct when they admit the "irregularity" and the absence of norm.[3] The latter writes:—"Nostri autem antiqui . . . usi sunt eo non observata lege . . sed . . alios (*i.e.*, versus) breviores alios longiores inseruerunt," and goes on to complain that he can hardly find two lines alike in Naevius. But if we disregard in large measure strict ideas of classical quantity, the case is different. By the "tonic accent" test they scan as well as the Germanic and give very similar results, and it seems unnecessary to deal with them in any other way.

But when we turn to Ennius probability becomes almost certainty. Ennius was the first to introduce an accurate Greek model, and like most neophytes he was very hard on the system he had deserted. Nor is he too modest about his own merits, for he hints that he is the first to "climb the cliffs of the Muses or give any care to style." He did not climb out of sight despite his famous piece of self-approval:

---

[1] cf. ll. 41, 48, 49, 50, 51, etc.

[2] cf. ll. 71, 99, 100, 101, 108, 109, etc.

[3] Keil: *Scriptores Artis Metricaæ*, VI. 139, 265.

> Scripsere alii rem
> Versibu', quos olim Fauni vatesque canebant,
> Quum neque Musarum scopulos quisquam superarat,
> Nec dicti studiosus erat."

From this we must certainly argue that the measure which in days of old, the Fauns and bards used to sing, was different in character from that of later days, and when we find in Ennius such monstrosities as,

> "**M**ater optumarum **m**ulto **m**ulier **m**elior **m**ulierum."[1]
> "O Tite **t**ute **T**ati **t**ibi **t**anta **t**iranne **t**ulisti,"

we must conclude that he is intentionally using this system and doing so to ridicule the ancient measure. But there is one other important point. It is a well-known fact that in the earliest Latin writers the accent was further forward than in the classical period. That again brought the old language nearer to the Teutonic and made a similar rhythmical structure more probable.

On the other hand classical Latin was due to Greek models, had strict quantity imposed upon it, and adopted a purely temporal standard. But even here, in line after line, the old alliterative type is seen, as an incidental element, down to the very last. The adoption of such a metrical system was only natural and for various reasons. A language highly and accurately inflexional, dominated by the grammarian and in contact with another that was hedged around by every rule of rhetoric and poetics which leisured philosophy could devise, was bound to reach an artificial index of rhythm. In the north it was otherwise. On the one hand want of a written literature ensured phonetic decay, and on the other our ancestors did not devote their whole time to pursuits of a purely literary character! With them the sword was still mightier than the pen and the way to Rome more congenial than the road to learning. Perhaps it was well for modern poetry that they did not adopt this artificial style, for the verse they had with its rhythmic beat was something stronger than the measures of Greece and Rome, and was better fitted to give rude yet impassioned expression to the thoughts of the men who were to carve their names upon the pillars of the world.

But apart from linguistic and grammarian agencies there were other influences at work in the south. Accent was falling nearer the end of the word and alliteration was therefore becoming more difficult. Besides, as even its best lovers will admit, it makes for strength rather than beauty. Now the æsthetic sense of the Latin influenced by the Greek recognised this and thus the evolution of a new system was accelerated and a verse was constructed which was intended to be lighter and more tripping, and which better matched the blue waters of the Mediterranean. But away on that northern sea-board and in the dark forests of Germany were men on whom the sun shone less brightly, men to whom the howling of the wind amid the forest glades or the long wild rush of the wintry sea was sweetest music, and these men retained intact the structure of the sterner muse.

---

[1] *Fragments*, 308.

It increased in strength, but away in the south the classical literature ere long lay dying. Loss of inflexion, the introduction of a "barbarian" element of population unversed in strict grammatical rule, and many other causes, were tempting the Roman to lay aside the yoke the Greek had laid upon him, and assert his individuality. In what direction was he to turn? Manifestly to the ancient well-springs of his genius—to the old accentual type. But the gradual throwing back of accent made the alliterative form a bond of servitude, and the catchwords now ended with the same letter instead of beginning. Therefore, rime was the result instead of alliteration—a result that became absolutely fixed when the Romance languages developed a strong vocalic element, and a distinct tendency to "ultimate" stress. It was rime at the end instead of "rime" at the beginning. It was the natural result, just as the evolution of the classical was the natural outcome of pre-existing conditions.

Gradually, too, through contact, the Teutonic style began to alter, and again a common type was reached. But in the far north alliterative verse developed on its own lines, and showed an accuracy of structure, and an intricacy and an ingenuity hardly surpassed by the classical age of Rome. Such a hold did it get, that to this day in Iceland, the popular ear is not satisfied without alliteration in addition to rime.[1]

Such is, in outline, my theory regarding alliteration as a formative agency in the evolution of poetry, and it is to be hoped that full investigation will lead to still more convincing results, and that the verse which even the genius of a Chaucer could not altogether overshadow, may yet have full honour paid to its greatness, and have its importance established and understood.

---

[1] cf. *C.P.B.* I. 458.

XIX.—*A Summary of Statistics relating to Vaccination and Smallpox as observed in the cases admitted to the City of Glasgow Smallpox Hospital, Belvidere, between 10th April, 1900, and 30th June, 1901.*

By R. S. THOMSON, M.D., D.Sc., F.F.P.S.G., F.R.S.E., Professor of Medicine, Anderson's College Medical School; Visiting Physician to the City of Glasgow Smallpox Hospital, Belvidere, and

ROBERT FULLARTON, M.A., M.B., Ch.B., late Acting-Superintendent, City of Glasgow Smallpox Hospital, Belvidere.

[Read before the Society, 2nd April, 1902.]

DURING the past two years Glasgow has suffered from one of the most severe epidemics of smallpox which has visited the city within recent times. The disease is still in our midst, and at present there are in the Smallpox Hospital close upon 200 patients. The epidemic began in April, 1900, and tailed off, as is so commonly the case with smallpox, on the advent of warmer weather, towards the middle of June of last year.

The purpose of this paper is to bring under the notice of the members of this Society what has been learned of the influence exercised upon smallpox by vaccination, by a study of the cases admitted from the beginning of the epidemic till its temporary cessation in June.

Before proceeding to consider the different points in detail, it will render the subject more clear if we discuss briefly the various terms used in the description of vaccinal scars, or what are more popularly known as "vaccination marks," as well as in the description of the smallpox eruption.

In every case admitted to the wards a note is made of the following points, namely, whether the patient is vaccinated, and if so, what is the number of recognisable vaccinal scars, and at the same time a careful description is written down of the characters presented by these. The characters of the vaccinal scars are of the first consequence in estimating the probable protective value of the vaccination, for, though vaccination with pure lymph produces a very characteristic scar, this may be much modified by secondary infection of the vesicle or pustule by pus-producing organisms during the acute stages of the process, and by age.

Vaccination performed with uncontaminated lymph, and which has not been complicated by secondary infection, results in a scar well defined at the margin, slightly depressed below the surface, and covered with minute pits or "foveae" Such a scar possesses the best possible characters, and indicates a vaccination of the most successful kind. When secondary infection of the vesicle or pustule by pus-forming organisms takes place, the point of inoculation becomes the seat of a process of ulceration, or even sloughing, and under these circumstances the vaccinal scar loses its characters, either in part or altogether, and instead of a scar such as has been described, we have one which presents little or no trace of foveation, which is glazed, irregular, and often puckered, resembling that produced by a burn of limited extent, but penetrating deeply through the true skin. In elderly persons even well foveated scars gradually become smoothed out, losing their foveation to some extent, and becoming ill-defined at the edges. Scars following on the healing of vesicles or pustules the seat of secondary infection are often very large, but it must be obvious that as the destructive process which produces them is dependent not upon the virus of vaccinia, but upon the presence of pus-forming organisms, it is impossible to gauge the protective influence indicated by such scars. Yet, judging from the experience gained in the Smallpox Hospital, it would seem as if the pyogenic organisms exercise some deleterious or inhibitory influence upon the vaccine virus, so that the degree of protection is not so great as the size of the scar might suggest.

The *scar area* or extent of surface covered by the "vaccination mark," is carefully measured, the area being expressed in tenths of a square inch. In the case of scars which are partly foveated or pitted, and partly free from foveation, the extent of the foveated area is also noted. In classifying scars as "foveated" and "non-foveated," it is customary in the Smallpox Hospital to regard as foveated all scars in which one half or more of the area is covered with foveae, while any scar which presents foveae over less than one half its area is regarded as non-foveated.

The condition of the patients as to vaccination leads to their distribution into three groups—"Vaccinated," "Unvaccinated," and "Doubtful."

All patients who show unequivocal evidence of "primary" vaccination, that is, who have been vaccinated once, either in infancy or in later life, and present one or more scars in evidence of this primary vaccination, are classed together as "Vaccinated," and all scars, however minute, and however far they may depart from the ideal standard, are accepted as evidence of vaccination. Persons who present no evidence of primary vaccination, and who state frankly that they have never been vaccinated, are classed as "Unvaccinated." Those who come much into contact with smallpox, are aware that among the patients, individuals are occasionally found who can give no information as to whether or not they have been vaccinated. If such individuals shew evidence of vaccination by the presence of vaccinal scars, they are regarded as having been vaccinated, but if there is no such evidence they are classed as "Doubtfully" vaccinated. Absolute want of knowledge with regard to vaccination is, however, rarely found. In addition to those cases in which no information is forthcoming, it is not very uncommon to meet with persons who declare they were vaccinated in infancy, but who present no local evidence in the shape of vaccination scars. In these also the vaccination is regarded as doubtful. Finally, in a small proportion of confluent cases, where the patient has come under observation late in the disease, it is impossible to discover any trace of vaccinal scars. In these the vaccination is regarded as doubtful unless the patient is clear that he is an unvaccinated subject. It would obviously be unjust to classify such persons as either vaccinated or unvaccinated, and consequently these constitute a third group of doubtful cases.

Though classed for statistical purposes among the Vaccinated, yet "Revaccinated" persons may fairly be regarded as forming a fourth group. As revaccinated are classed those in whom there is a clear history of a second vaccination having been performed at some period subsequent to the primary operation. It will be proper to state here that many persons in whom revaccination has been attempted, but in whom no reaction followed upon the operation, consider themselves revaccinated; yet it must be obvious that revaccination can be regarded as having been performed only when the person has presented a distinct local and constitutional reaction. The evidence of revaccination is often purely historical, on account of the rapidity with which in some cases the scars become effaced even when the revaccination has resulted in a decided local reaction.

During an epidemic all "Contacts" who will submit to the operation are vaccinated or revaccinated as the case may be. If the operation has been performed during any part of the "incubation period," that is to say, during the period which elapses between exposure to infection and the first appearance of symptoms, a period which varies from eight to seventeen days, but is most commonly eleven or twelve, the operation is not regarded as a revaccination in the ordinary sense. A true revaccination must be performed *before* exposure to infection.

In studying the relationship existing between vaccination and smallpox it is important that the members of this Society should have some knowledge of the disease with which we are dealing, especially with regard to its various grades of severity. When smallpox for the first time attacks a person who has never been vaccinated, the disease is said to run an "unmodified" course. In vaccinated persons, however, so long as the vaccination continues to confer some degree of immunity, the disease does not follow the usual course, and the attack is said to be "modified." It is a mistake to suppose that all unmodified attacks are necessarily severe, for individuals manifest very various degrees of susceptibility to the contagion. Some persons who have never been vaccinated apparently enjoy complete immunity against the disease, and in the Smallpox Hospital at least two such persons have come under observation during the last ten years, both living in the wards among the Smallpox patients apparently in perfect security: neither of these was susceptible to vaccination. All grades of susceptibility are found in unvaccinated persons between this apparent immunity and the highest grade of susceptibility, such as is probably present in those who are attacked by the disease in its virulent forms.

In both modified and unmodified smallpox the *amount* of the eruption is commonly regarded as indicating the severity of the attack, but it should be pointed out that this is not an invariable guide, as in modified cases a most profuse eruption not unfrequently "aborts," or in other words, the rash does not pass through all its stages of development, as it invariably does in the unmodified disease, the attack ending late in the vesicular or early in the pustular stage. In persons suffering from a second attack of smallpox the eruption runs a similarly modified course.

With this reservation, it is found convenient for purposes of classification to divide all cases of smallpox into groups according to the abundance of the eruption on the patient's face. When the eruption appears on the face in the form of isolated pocks the case is regarded as a "discrete" one, but it must be remembered that in this class are included not only the milder cases with perhaps not more than half-a-dozen pocks in all, but also a fair number of considerable severity, in which there may be many hundreds of pocks scattered over the surface of the body. When the pocks are so abundant on the face and possibly on other parts that they come into contact by their edges, the case is regarded as "confluent," and the patient, if unvaccinated, is the subject of an attack of great severity.

In addition to these classes there is a third group of cases in which the eruption is usually very abundant if the patient survive for eight or ten days, and in which in addition to the true and characteristic eruption of smallpox, there are present in the skin and mucous membranes hæmorrhages varying in size and in number. In many of these patients hæmorrhage takes place from the nose, lungs, stomach, bowel, kidneys, etc. If death occur early in the attack, the characteristic eruption of pocks may be almost absent. Such cases constitute the "malignant" or "hæmorrhagic" group. It must be understood that the grades of severity indicated by this classification are "discrete" or comparatively mild, "confluent" or very severe, and lastly the true "hæmorrhagic" condition, in which recovery rarely takes place. As already stated, however, many of the cases classed as confluent are by no means so severe as would be suggested by the amount of the eruption, for it is only in unvaccinated persons and in those who have completely lost the immunity originally conferred by primary vaccination, that the eruption follows its normal course of development, while in those who still enjoy a certain degree of immunity, the eruption, though abundant, runs a comparatively short-lived course.

Bearing these facts clearly in mind we are now in a position to enquire what influence vaccination was found to exercise on the course and termination of smallpox as seen in the wards of the Hospital. During the period under consideration 1,810 persons were admitted to the wards suffering from this disease. Of these, 1,643 were vaccinated, in 45 the vaccination was doubtful, while 122 were avowedly unvaccinated.

The influence of vaccination upon smallpox may be studied along various lines, but perhaps the most striking results are obtained when we compare the case mortality among the vaccinated, doubtfully vaccinated, and unvaccinated. Of 1,643 vaccinated persons 150, or 9·13 per cent. died; of 45 doubtfully vaccinated persons 25, or 55·55 per cent. died; while among 122 unvaccinated persons there were 63 deaths, giving a case mortality of 51·64 per cent. In all of the 1,810 patients admitted, 238, or 13·15 per cent. died. These figures can be more readily compared in the accompanying table.

TABLE SHOWING RELATIVE CASE MORTALITY IN VACCINATED, DOUBTFUL, AND UNVACCINATED CASES.

Condition as to Vaccination.	Number of Cases.	Deaths.	Per Cent.
Vaccinated, - - -	1,643	150	9·13
Doubtful, - - -	45	25	55·55
Unvaccinated, - -	122	63	51·64
	1,810	238	13·15

From this it will be seen that the mortality among vaccinated persons is less than one-fifth of the mortality among unvaccinated, and curiously enough only about one-sixth of that occurring among persons doubtfully vaccinated. This latter result does not correspond with what was observed in the epidemic of ten years ago, in which the case mortality among the doubtfully vaccinated was little more than one-half of that among the unvaccinated.

The higher case mortality observed in the present epidemic among the doubtfully vaccinated as compared with the unvaccinated is probably in part the result of the smaller number of the former coming under observation; but it must be remembered that though, as will be shewn in a subsequent part of this paper, some of those classed as doubtful were probably vaccinated in infancy, yet in them the operation was so inefficiently carried out that it conferred an immunity of a very temporary character only, and consequently such persons, when brought into contact with the smallpox contagion, were really in the position of those who had never been vaccinated. Examples of this shortlived immunity are not infrequently seen in the smallpox Hospital, where children suffering from diseases other than smallpox, and with imperfect vaccination scars, if revaccinated within one or two years after the primary operation, pass through a typical attack of vaccinal fever, with a characteristic local reaction which runs the usual course. The vaccinator or the lymph employed is not always responsible for the partial or total failure of the operation, for attempts more or less successful are quite commonly made by parents or guardians who disapprove of vaccination to render the operation useless, by washing or sucking the part to remove the lymph before it becomes dry.'

In connection with the question of doubtful vaccinations it has been suggested that a reference to the books of the Registrar might clear up the doubt, but though this source of information might sometimes prove useful, it would not infrequently afford no assistance of any value, as the experience of the hospital shews that children are sometimes registered as successfully vaccinated who present, even a few weeks after the alleged operation, no discoverable trace of a vaccinal scar.

It might be urged that all the doubtful cases should be regarded as vaccinated, though, in view of what has been said on the point, this would be manifestly unjust. Yet, for the sake of contrast, we may for a moment regard the doubtfully vaccinated as belonging to the vaccinated class of persons, and what result do we get? Among a total of 1,688 persons suffering from smallpox we have 175 deaths, or a case-mortality of 10·41 per cent., that is, the case-mortality is raised by only 1·28 per cent. It would be equally unjust to regard these doubtful cases as unvaccinated, but if we include them in the unvaccinated class, we have a total of 167 cases with 88 deaths, giving a case mortality of 52·7 per cent., or 1 per cent. greater than that of the unvaccinated class.

Leaving the doubtful cases out of consideration, and confining our attention to the vaccinated and unvaccinated, as given in the above table, we are driven to the conclusion that, whatever direct or indirect influence vaccination may have upon the result, vaccinated persons run a much smaller risk of death in the event of their contracting smallpox than do those who are unvaccinated.

It may be asked why the case mortality among unvaccinated persons is greater at present than it is said by some to have been in pre-vaccination times. In reply, it may be pointed out, in the first place, that there are no really reliable statistics dealing with large masses of cases; and in the second, that the available statistics are vitiated by their including persons suffering from inoculated smallpox, a form of the disease which was notoriously mild. Apart from statistics, however, a fair idea may be gathered from the works of the older writers of the dreadful mortality which prevailed in their time among the victims of smallpox, compared with which the present mortality among unvaccinated persons does not seem to be unduly great.

Almost as striking as the relative case-mortality is the comparative severity of the attack, as studied in vaccinated, doubtfully vaccinated, and unvaccinated persons. Among 1,643 vaccinated persons there were 1,361 or 82·8 per cent. of discrete, or, in other words, comparatively mild cases; 237 or 14·4 per cent. of a more severe type, in which the eruption was confluent; and 45 persons or 2·8 per cent. suffered from malignant smallpox.

Of 45 doubtfully vaccinated persons 15 or 33·3 per cent. passed through an attack associated with a discrete eruption, while in 25 or 55·6 per cent. the eruption was confluent, and hæmorrhagic in 5 or 11·1 per cent.

One hundred and twenty-two unvaccinated persons came under observation, of whom only 53 or 43·3 per cent. were discrete, 65 or 53·3 per cent. were confluent, and 4 or 3·3 per cent. hæmorrhagic. This contrast is brought out in the accompanying table—

TABLE SHOWING SEVERITY OF ATTACK IN VACCINATED, DOUBTFUL, AND UNVACCINATED CASES.

Condition as to Vaccination.	Discrete.	Confluent.	Hæmorrhagic.
Vaccinated, -	1,361. 82·8 per cent.	237. 14·4 per cent.	45. 2·8 per cent.
Doubtful, -	15. 33·3 ,,	25. 55·6 ,,	5. 11·1 ,,
Unvaccinated, -	53. 43·4 ,,	65. 53·3 ,,	4. 3·3 ,,

which shows, with great clearness, that a vaccinated person contracting smallpox, has the advantage over one who is either unvaccinated or doubtfully vaccinated; so that, whatever view may be taken as to the causative influence exercised by vaccination, persons successfully vaccinated not only run less risk of death when attacked by smallpox, but also as a rule pass through a milder attack than do their less fortunate unvaccinated fellows; and, though this fact is not brought out in either of the tables we have discussed, yet it is a fact that disfigurement, such as pitting, deafness, and blindness, and permanent injury to health are most exceptional among the vaccinated.

Not only do vaccinated persons suffer less themselves, but they are likewise the cause of less suffering to their families, and a source of less expense to the community. An attempt is made to show this in the following table, which deals with the duration of the patients' stay in hospital, in those cases where the illness terminated favourably.

TABLE SHOWING AVERAGE DURATION OF STAY IN HOSPITAL IN VACCINATED, DOUBTFUL, AND UNVACCINATED CASES.

Vaccinated cases	detained	an average of	29	days.
Doubtful	,,	,,	41	,,
Unvaccinated	,,	,,	56	,,

It will be seen that the average residence of vaccinated was practically one-half that of unvaccinated persons, or in other words those who had been even once vaccinated were able to return to their families, and, so far as their health was concerned, resume their ordinary occupations twenty-seven days sooner than their unvaccinated companions. As most of the patients belong to the working-class, the early return of the bread-winner to his home is a matter of importance for those he is called upon to support. But the influence of his earlier dismissal from hospital goes further than this, extending immediately to his employers and fellow-workmen, whose business is often hampered by his absence; and even the community at large is affected favourably by the vaccinated as contrasted with the unvaccinated patient, for, taking the average expenditure for each patient in hospital at 4s. 6d. per day, we find that while each vaccinated person costs the ratepayers £6. 10s. 6d. during his detention in hospital, the unvaccinated costs £12. 12s. or nearly double that sum.

Turning now to the vaccinated cases, an attempt will be made to discover whether the number, size, and characters of the vaccinal scars constitute any index of the degree of protection—afforded by primary vaccination.

The ***number*** of the vaccinal scars will be discussed first.

TABLE SHOWING RELATION BETWEEN NUMBER OF SCARS AND SEVERITY OF ATTACK.

Number of Scars.	Discrete.	Confluent and Hæmorrhagic.	Deaths.	Total Cases.
One scar, - -	709	177	101	886
Two scars, - -	506	83	43	589
Three scars, - -	81	13	4	94
Four scars and over,	65	9	2	74

TABLE SHOWING THE SAME FIGURES REDUCED TO PERCENTAGES OF THE TOTAL CASES IN EACH CLASS.

Number of Scars.	Discrete.	Confluent and Hæmorrhagic.	Deaths.
One scar, - - - - -	80	20	11·4
Two scars, - - -	85·9	14·1	7·3
Three scars, - - - - -	86·2	13·8	4·2
Four scars and over, - - -	87·8	12·2	2·8

From this table it will be seen that out of a total of 1,643 smallpox patients, 886 presented one scar, 589 two, 94 three, and 74 four scars and upwards; and in addition that the degree of protection was in direct proportion to the number of scars. The percentages showing the number of discrete or mild cases, while they indicate an increase in the degree of protection with an increase in the number of scars, do not show any striking difference between each of the four groups. This slight difference is precisely what is to be anticipated when we remember that the great majority of vaccinated persons who contract smallpox suffer from a discrete or modified attack, whatever the number of vaccinal scars. The difference, however, is more striking when we consider the case-mortality in the various groups. A glance at the table will show that while persons presenting only one scar had a case-mortality of 11·4 per cent., those who presented four scars or upwards had a case-mortality of only 2·8 per cent., a fact which, so far as it goes, is in favour of vaccination being performed at more than one point. From this the question arises whether the comparative immunity enjoyed by persons with four vaccinal scars, as compared with those possessing fewer, is to be estimated by the number of scars present, or whether the greater degree of protection is associated with the greater *scar area.* Most persons who have been vaccinated at more than one point present as a rule vaccinal scars which differ from one another in form and character, but more especially in size, and the question to be decided is whether the size of the area covered by vaccinal scarring is in any way proportionate to the degree of immunity enjoyed. In the accompanying table an attempt is made to throw light upon this point.

TABLE SHOWING RELATION BETWEEN AREA OF SCARS AND SEVERITY OF ATTACK.

Area of Scars in sq. in.	Discrete.	Confluent and Hæmorrhagic.	Deaths.	Total. Cases
Under ·25 - -	187	71	50	258
·25—·5 - - -	369	98	61	467
·5—1 - - -	520	79	34	599
1 and over - -	285	34	5	319

TABLE SHOWING THE SAME FIGURES REDUCED TO PERCENTAGES OF THE TOTAL CASES IN EACH CLASS.

Area of Scars in sq. in.	Discrete.	Confluent and Hæmorrhagic.	Deaths.
Under ·25	72·5	27·5	19·4
·25—·5	79	21	13
·5—1	86·8	13·2	5·7
1 and over	89·3	10 7	1·6

Formerly, vaccinal scars were classed as "very good," "good," "indifferent," "bad," and "very bad," and the older statistics dealing with vaccination employ this or a similar classification, which embodies not only the size of the vaccinal scars, but their characters as well. The objection to this classification is obviously that it leaves too much to be determined by the personal equation of the observer, and consequently it became necessary in the preparation of detailed statistics to employ accurate methods of measurement. A number of years ago the Metropolitan Asylums' Board introduced a method which admits of the ready comparison of scars presenting different forms and sizes. According to this method each scar is carefully measured, and the total combined vaccinal scar area is expressed in inches and tenths of an inch. In the above table the cases are divided according as their total scar area measured less than a quarter of a square inch, from quarter to half a square inch, from half to one square inch, and one square inch or over. The severity of attack is indicated by the terms discrete or confluent and hæmorrhagic. A glance at the table will show that the percentage of discrete cases is directly as the scar area, there being about 17 per cent. more discrete cases where the scar area measured over one inch, than where it measured less than a quarter of a square inch. A similar comparative immunity will be noticed if we glance at the percentages of the severer cases, for while persons possessing a scar area of less than one quarter of a square inch presented 27·5 per cent., those with a scar area of over one square inch presented only 10 per cent. of the more severe forms of the disease. The case mortality is even more striking, for while there were 19·4 per cent. of deaths among persons with a scar area measuring less than one quarter of a square inch, among persons with a scar area over one square inch the case-mortality was only 1·6 per cent.

The limits of this paper prevent a detailed discussion of the scar characters, which would involve a degree of technicality to be fully appreciated only by those familiar with vaccination and its results. But it may be of interest to discuss shortly at least one characteristic of all satisfactory vaccinal scars, namely, *foveation.* In the appended table the cases are divided according as the scars did or did not possess this character.

TABLE SHOWING INFLUENCE OF VACCINATION ON SEVERITY OF ATTACK AND CASE-MORTALITY WHEN SCARS ARE "FOVEATED" AND "UNFOVEATED."

	Discrete.	Confluent.	Hæmorrhagic.	Deaths.
Character of attack in 655 Persons with Foveated Scars, -	573	75	7	43
Per Cent., - - - - -	87·5	11·5	1	6·6

	Discrete.	Confluent.	Hæmorrhagic.	Deaths.
Character of attack in 988 Persons with Unfoveated Scars, -	788	162	38	107
Per Cent., - - - - -	79·8	16·4	3·8	10·8

A definition of what is meant by foveation and non-foveation has been given in a former part of this paper. It will be seen from the table that of 1,643 vaccinated persons, 655 possessed foveated scars, and 988 scars which were regarded as unfoveated. The statistics here given are distinctly favourable to those with foveated scars, for while among these there were 87 5 per cent. of milder cases, there were 79·8 per cent. among those whose scars were unfoveated. Among the more severe cases a similar comparative immunity is seen, for while there were only 11·5 per cent. of confluent cases, and only 1 per cent. of hæmorrhagic in those with foveated scars, there were 16·4 per cent. of confluent, and 3·8 per cent. of hæmorrhagic cases among those whose scars were not foveated. The case-mortality in the two classes points in the same direction, for while there were 6·6 per cent. of deaths among the foveated, the unfoveated showed a mortality of 10·8 per cent.

Turning now to another part of our subject, the *age-incidence* of the disease falls to claim our attention. This will be discussed first, as it appears among persons who have been vaccinated in infancy or in later life, secondly, in those who avowedly have never been vaccinated, and lastly, as it appears in those persons in whom vaccination is doubtful.

Our first table deals with vaccinated persons only.

TABLE SHOWING SEVERITY OF ATTACK AND CASE-MORTALITY IN VACCINATED CASES AT DIFFERENT AGE PERIODS.

Age.	Discrete.	Confluent.	Hæmorrhagic.	Total.	Deaths.	Mortality. per Cent.	Percentages of Severe Cases.
0.5	3	—	—	3	1	33·3	—
5-10	30	1	—	31	—	—	3·2
10-15	89	4	—	93	1	1·1	4·3
15-20	122	9	—	131	—	—	6·9
20-25	225	24	5	254	12	4·7	11·4
25-35	525	87	15	627	42	6·7	16·3
35-45	253	75	14	342	51	14·9	26
45-55	82	29	6	117	26	22·2	30
55-65	19	7	5	31	13	41·9	39
65 and over	13	1	—	14	4	28·6	7·1
	1361	237	45	1643	150		

The cases are grouped in quinquennial age periods up to the age of twenty-five years, and in decennial periods beyond that age. A glance at its column reveals a most interesting fact, and one which has been commented upon from the earliest period of general vaccination, namely that out of 1,643 cases of smallpox occurring in vaccinated persons, only 258—or 15·7 per cent. of the whole—were under twenty years of age, and further, that of this number only two or about 0·8 per cent. died. The absence of severe cases during the same age-period is also strikingly shown, as only 14 or 5·4 per cent. of the cases were confluent, and none were hæmorrhagic. Over the age of twenty we find that the state of matters changes, both as regards the number of persons contracting the disease, and the percentage of severe cases and of deaths. It will be noted that from the age of twenty onwards, and including the age-period from 55 to 65 years, there is a steady increase both in the percentage of severe cases, and in the case mortality, while in the last age-period there is a decided fall in both.

The figures indicate the existence of a distinct relative immunity under the age of twenty, which it seems reasonable to attribute to the primary vaccination, and also that this immunity is gradually lost as the years advance, disappearing completely at various ages, the period of its disappearance seemingly depending upon the efficiency of the vaccination. When this protection is completely lost the patient reverts to the condition of one who has never been vaccinated, so that the course and result of his attack show no modification.

The fall in the case-mortality, and in the number of severe cases over the age of sixty-five, would suggest that over a certain age a natural relative immunity becomes developed.

Our next table deals with unvaccinated cases only.

TABLE SHEWING SEVERITY OF ATTACK AND CASE MORTALITY IN UNVACCINATED CASES AT DIFFERENT AGE PERIODS.

	Discrete.	Confluent.	Hæmorrhagic.	Total.	Deaths.	Mortality per Cent.	Percentage of Severe Cases.
0-5	29	25	—	54	36	66·6	46·3
5-10	5	7	—	12	2	16·6	58·3
10-15	5	8	1	14	4	28·6	64·3
15-20	3	3	—	6	2	33·3	50
20-25	1	5	—	6	4	66·6	83·3
25-35	3	7	1	11	5	45·5	72·7
35-45	4	6	2	12	4	33·3	66·6
45-55	3	4	—	7	6	85·7 .	57·1
55-65	—	—	—	—	—		
65 and over	—	—	—	—	—		
	53	65	4	122	63		

On contrasting the figures in this with those in the last table, we find a complete reversal of what is seen in vaccinated individuals. Out of a total of 122 unvaccinated cases no fewer than 86 or 78·5 per cent. occurred under the age of 20 years, while 54 or 44·3 per cent. of these occurred during the first quinquennial age period. This forms a striking contrast to what we saw existing among vaccinated persons, of whom only 15·7 per cent. were under 20 years of age, and only 3 or 0·2 per cent. were under the age of five. The conditions here demonstrated are precisely those which existed in prevaccination days, when smallpox, like measles, scarlet fever, and whooping cough, was strictly speaking a disease of childhood, the disease being less prevalent among adults, as measles is at the present day, probably because in communities between which free intercourse existed smallpox attacked every susceptible individual exposed to the infection, during the earliest years of life.

It is not the object of this paper to bring forward arguments or special pleading, its object is to set forth facts, and whatever explanation is offered, the bare fact remains that a disease which before the introduction of vaccination was notoriously a disease of early life, has so altered its age-incidence that in a community such as our own it has practically vanished from among vaccinated children under 5 years of age. It has been pointed out in another part of this paper that the case mortality among the unvaccinated patients was 51·64 per cent. An analysis of our table gives further information on this point. Of the 86 patients under 20 years of age, 44 or 51·2 per cent. died, and all of these were cases of the severest type; or to put it another way, of the 63 deaths which occurred among the unvaccinated patients, 44 or 71·4 per cent. were under the age of 20. Further, if we select the first quinquennial age period among the vaccinated, and contrast it with the corresponding period among the unvaccinated, we find that while in the former of three patients one died, in the latter of 54 patients 36 or 66·6 per cent. died.

Our next table deals with the age-incidence among persons in whom vaccination had been doubtfully performed. It is impossible of course to say what proportion of these were vaccinated and in what proportion vaccination had not been performed at all, but the mere classification of such cases as doubtful is sufficient to shew that if vaccination had ever been performed the operation must have been so inefficiently carried out that the local manifestations had in most part completely disappeared, probably long before the patient came under observation.

TABLE SHEWING SEVERITY OF ATTACK AND CASE-MORTALITY IN DOUBTFUL CASES AT DIFFERENT AGE PERIODS.

	Discrete.	Confluent.	Hæmorrhagic.	Total.	Deaths.	Mortality per Cent.	Percentage of Severe Cases.
0-5	2	1	—	3	—	—	50
5-10	2	—	—	2	—	—	—
10-15	2	—	—	2	1	—	50
15-20	1	1	—	2	1	50	50
20-25	—	2	1	3	2	66·6	100
25-35	3	8	1	12	9	75	75
35-45	2	8	1	11	6	54·5	81·8
45-55	2	3	2	7	4	57·2	71·4
55-65	—	2	—	2	1	50	100
65 and over	1	—	—	1	1	100	—
	15	25	5	45	25	55·55	66·6

This table does not suggest anything particularly striking, but attention may be called to one or two points. Of the 45 cases observed, 9 were under the age of 20, and 36 over that age. Of the cases under the age of 20, two died and two were severe, while over this age there were 23 deaths, more of these occurring between the ages of 25 and 35 than at any other age period.

The small number of cases under the age of 20 is comparable to what we saw in the table dealing with vaccinated persons, and suggests that many of the so-called doubtfully vaccinated had really been vaccinated at one time. The same is suggested by what we observe above the age of 20. The heaviest case-mortality among vaccinated persons was found between the ages of 55 and 65, as contrasted with the doubtfully vaccinated, among whom as already seen the greatest case-mortality occurred between the ages of 25 and 35 years. So that those persons classed as doubtful, though in many cases vaccinated in infancy yet were only temporarily protected by an operation so inefficiently performed that both the local scarring and the associated immunity disappeared at a comparatively early date thereafter. The temporary character of the protection indicated by the presence of scars of small size has already been referred to.

So far we have discussed the influence of *primary* vaccination only upon the course of termination of smallpox, and now it falls naturally to ask whether *revaccination* exercises any influence upon smallpox, either in protecting the person completely, or in modifying the attack should the disease be contracted. Just as the extent of protection afforded by primary vaccination bears some relation to the size and character of the resulting scars, or, in other words, to the efficiency of the operation, so, no doubt, the degree of protection afforded by revaccination will likewise depend upon the efficiency of the operation. Uniformity of result can be looked for only when there is uniformity in the operation itself, that is to say, when the operation is carried out on one general plan; for, so long as one vaccinator considers that a scar, say the size of a shilling, is necessary to afford protection, and another that an area the size of a split pea will suffice, we cannot expect to find uniformity either in the degree or permanence of resulting immunity. Whether revaccination is the causative influence or not, it is undoubted that revaccinated persons rarely suffer from smallpox, and so far as the evidence of the present epidemic shews, recently revaccinated persons do not contract the disease at all. But here it is important to correct a common misapprehension as to what is meant by "revaccination." It is quite common, during the currency of an epidemic to be told that certain individuals have contracted smallpox within a variable but short period after revaccination. Careful enquiry invariably shews that this statement is without foundation, and that the attempted revaccination had proved unsuccessful. Revaccination is not constituted by a few scratches made on the arm with a lancet or needle, and the rubbing in of a small quantity of vaccine lymph; to be successfully revaccinated the person must show both a local and general reaction, or, in other words, he must become the subject of an attack of vaccinal fever. If this double reaction does not take place, then either the individual is insusceptible, or the lymph and method of operating are defective. Again, it is common to find persons developing symptoms of smallpox a few days after successful revaccination; that is to say, the operation has been carried out during the period of incubation which, as already pointed out, extends on an average over eleven or twelve days. These persons are not revaccinated in the ordinary sense, in so far that the disease has been already contracted before the performance of the operation, though its symptoms do not appear till later. We shall see later on that revaccination, performed in the earliest days of the incubation period, seems to afford considerable protection against the disease.

We shall first consider the influence of recent revaccination when carried out efficiently. In the following table will be found details of revaccinated persons who were exposed, during longer or shorter periods, to smallpox infection within the area of the Smallpox Hospital, and in whom revaccination was performed by the medical officers of the smallpox staff, whose reputation for efficient revaccination cannot be questioned.

NUMBERS OF STAFF, WORKMEN, AND OTHERS EXPOSED TO INFECTION WITHIN THE HOSPITAL PRECINCTS, SHOWING PROTECTIVE INFLUENCE OF REVACCINATION.

	Total Numbers.	Revaccinated or recently Vaccinated for first time.	Not Revaccinated.	Contracted Smallpox.	Deaths.
Medical and Nursing Staff, -	80	80	—	—	—
Practitioners and Students, -	150	150	—	—	—
Hospital Servants, - -	50	50	—	—	—
Workmen, - - - -	230	217	13	5	1
Vanmen calling at Hospital,	7	6	1	1	—
Patients suffering from Diseases other than Smallpox; Nursing Mothers, etc., -	236	236	—	2[1]	—
	753	739	14	8	1

---

[1] These two cases were revaccinated with lymph which proved to be deficient in potency. This same lymph was found to be defective by others engaged in revaccination outside the Hospital.

Within the wards of the Hospital were employed 80 persons, constituting the medical and nursing staff, and 50 wardmaids and other attendants, all of whom were brought into most intimate contact with the ward inmates, and were consequently exposed to the infection in its most concentrated form. In addition to these, 236 persons, who were not suffering from smallpox, were brought in the wards of the Hospital into even closer relationship with the infection, in so far that these persons actually lived both day and night in the wards, occupying beds side by side with those in which smallpox patients lay. This number was made up of persons admitted with diseases other than smallpox; of persons without any discoverable disease; of mother's nursing their smallpox infants, and of healthy infants who were being suckled by their mothers who themselves were suffering from smallpox. It has been the custom in the Smallpox Hospital to revaccinate such persons immediately on admission, and thereafter daily till signs of local reaction appear, or the physician is satisfied that the patient is insusceptible to vaccinia, and presumably to smallpox also. In most of these cases *revaccination* is performed, but in the case of children at the breast the operation is commonly a *primary* one. These persons, as has been said, live among smallpox patients without any attempt at isolation, and many of them assist in the work of the wards. Mothers suffering from smallpox, if they are not too ill, are allowed to suckle their healthy children who, of course, are thoroughly vaccinated. Yet, in spite of the intimate contact between these recently revaccinated persons and the smallpox patients, it is excessively rare to find any of them contracting the disease; and when such an accident does happen, a careful search is certain to reveal some defect, most commonly in the lymph. During the period under consideration, of the 236 persons just mentioned only two contracted smallpox, and in both the disease was of so mild a type that the attack might quite readily have escaped notice. The explanation here seemed to lie in the fact that the vaccine lymph employed was deficient in potency, and the reaction, in spite of repeated daily vaccination, was so long delayed that these patients were in the same position as persons in whom the operation had been performed for the first time some days after exposure to the infection. Complaints of the quality of this particular batch of lymph were made both by physicians and inspectors who were engaged in the work of revaccination outside the Hospital.

The numbers of those brought into intimate contact with the contagion of smallpox within the wards might be greatly increased, for at the acme of the epidemic the accommodation provided by the Smallpox Hospital was found to be insufficient, and sixteen wards of the Fever Hospital at Belvidere were for several months used for the overflow cases. In this way, practically the whole staff of the Fever Hospital, numbering 230 persons, all of whom had been revaccinated some time previously, was brought into the same relationship with the disease as the staff of the Smallpox Hospital itself; yet no member of the Fever staff contracted the disease.

During the prevalence of smallpox in the city, clinical demonstrations of the cases are given at intervals for the instruction of those practitioners and students who care to take advantage of them. To these demonstrations no one is admitted who has not been successfully revaccinated within three years, or has proved himself insusceptible after repeated attempts at revaccination. During the epidemic of last year 150 persons attended these demonstrations, and not one contracted smallpox.

It is well known that smallpox is one of the most infectious of the specific fevers, and that to contract it, it is not necessary that the susceptible individual should come into direct contact with a person suffering from the disease, or with infected articles, for there is reason to believe that the contagion may be conveyed even considerable distances through the air. It will be clear, therefore, that the whole precincts of the Smallpox Hospital must be considered an infected area, and any susceptible person entering this area will run a very serious risk of contracting the disease. It is further known that a susceptible person may contract the disease as the result of a very short exposure to the infection. This last fact is illustrated by the following incident. The Hospital supplies are brought from the outside, and there is a standing rule that all vanmen employed in this service must have been successfully revaccinated. Six regular vanmen, all of whom had been revaccinated, were employed, and none of these took smallpox, but on one occasion a substitute, who had not been revaccinated, was sent in place of one of these. This man paid only one visit to the Hospital, and was admitted a fortnight later with smallpox.

In this connection an experience falls to be related which presents all the conditions necessary for an experiment in the pathology of infection. As the epidemic spread, the permanent wards of the Smallpox Hospital were found to be insufficient to accommodate the increasing number of patients, and the Corporation decided to erect temporary pavilions within the Hospital grounds. On these 230 workmen comprising joiners, labourers, zinc workers, and engineers were employed. Of the total, 217 were successfully revaccinated immediately on commencing work, while thirteen either refused to be revaccinated or escaped revaccination through some misunderstanding or oversight. These men occupied the same class of houses, they lived upon similar food, they held the same social status, and not one belonged to the so-called "vagrant" class. They were all respectable men of the working class, and were exposed to precisely the same conditions while engaged in their work within the Hospital precincts. In fact, we have here all the conditions which would be considered essential in any experiment in biological science. Now see what happened. Of the 217 successfully revaccinated workmen *not one contracted Smallpox,* while of the thirteen who escaped revaccination *five contracted the disease and one died.*

From what has been said it is evident that whether revaccination was responsible for the immunity enjoyed by all but eight of the persons classified in the foregoing table, or not, the revaccinated persons did escape the disease, while half of those who were not revaccinated contracted it.

The persons referred to in the last few paragraphs were apparently completely protected by recent revaccination, or in other words, they apparently enjoyed for the time complete immunity. The question, however, arises whether this immunity is permanent or whether it diminishes by lapse of time and finally disappears. During the past ten or twelve years revaccination has been carried on in Glasgow to a considerable extent, and consequently we had in our midst prior to the commencement of the epidemic of last year a fair number of revaccinated persons. It was therefore of interest to observe what proportion of the patients admitted during the epidemic had been revaccinated. Out of the total number of admissions only eight were found to have been successfully revaccinated prior to their exposure to smallpox. The annexed table gives a list of these, and it will be noted that the person most recently revaccinated had submitted to the operation four years previously. As there was reason to doubt the correctness of the date given by this patient, it is preceded in the table by a mark of interrogation.

TABLE SHOWING, IN CASES SUCCESSFULLY REVACCINATED BEFORE INFECTION, THE INFLUENCE OF REVACCINATION ON SEVERITY OF ATTACK.

Case.		Primary Vaccination.	Date of Revaccination.	Character of Attack.
No. 1,	Aged 25	1 mark—poor.	6 years ago.	Very sparse.[1]
,, 2,	,, 43	1 ,, fair.	11 ,,	Sparse.
,, 3,	,, 44	1 ,, poor.	21 ,,	Very sparse.
,, 4,	,, 37	1 ,, poor.	27 ,,	Fairly abundant.
,, 5,	,, 48	1 ,, poor.	28 ,,	Very sparse.
,, 6,	,, 43	3 ,, poor.	31 ,,	Sparse.
,, 7,	,, 42	2 ,, fair.	32 ,,	Very sparse.
,, 8,	,, 28	1 ,, fair.	?4 ,,	Fairly abundant.

This list is a short one and the details require no comment, but the conclusion we are forced to from its study is that revaccination does not invariably afford a complete and permanent protection against smallpox. As already pointed out, the extent and permanence of the immunity will depend largely on the efficiency of the operation, and it is exceedingly difficult in view of this to estimate the degree of immunity enjoyed by any individual who has been revaccinated; and more especially is this the case where the revaccination has left little local scarring. How long the immunity afforded by thorough revaccination may last is a question very difficult of settlement. To judge by the list before us it seems that in one case where revaccination was undoubted the person contracted smallpox six years later, but in this case the scar pointed to a very inefficiently performed operation. Though little can be decided with regard to this point, it may be of interest to know that there are at present in the Smallpox Hospital nurses who apparently still enjoy complete immunity, whose last successful revaccination was performed ten or more years ago.

The conditions as regards susceptibility in revaccinated persons are probably somewhat similar to those in persons who have already had smallpox, and it is a matter of great interest to note that during the epidemic six persons at least were admitted with a second attack of this disease. The details of these are given in the following list:—

---

[1] The patient was a housemaid in the service of the Fever Hospital.

	Age.	Date of First Attack.	Character of Case.
No. 1.—	50.	Precise date of first attack not known,	Fairly abundant.
,, 2.—	50.	9 years ago, - - - - - -	Abundant, but ran rapid course.
,, 3.—	32.	10 years ago, - - - - - -	Very sparse.
,, 4.—	50.	40 years ago, - - - - - -	Very sparse.
,, 5.—	50.	46 years ago, - - - - - -	Sparse.
,, 6.—	54.	In early infancy, - - - - -	Very sparse.

It may be stated that these patients, with the exception of the last, had been vaccinated in infancy, that the second on the list was an inmate of the Hospital nine years ago, when he passed through a very sharp attack of smallpox, and that in the first two cases the disease ran a course of considerable severity, in spite of the immunity which was presumably conferred by their former attack. None of these died. In addition to the cases enumerated in this list, several others stated they had passed through an attack of smallpox in earlier life, but as the historical evidence was not regarded as satisfactory, they have been omitted from our list.

It is almost certain that at the commencement of the outbreak of smallpox in 1900, there were more revaccinated individuals in our midst than there were persons who had already passed through an attack of smallpox, and yet we find that only eight of the former contracted the disease, while six incurred a second attack. Two of the cases passed through the second attack within ten years of the first, an experience comparable with that observed on studying the list of revaccinated persons, where, if we omit the last case in whom the date of revaccination is doubtful, we find that in the first two cases the period which elapsed between the date of revaccination and the attack of smallpox was in the one six, and in the other eleven years. In other points the two lists resemble each other pretty closely.

It would be unwise to dogmatise with regard to the relative immunity conferred respectively by revaccination and a former attack of smallpox, yet the experience of the outbreak would suggest that a revaccinated person is quite as safe from smallpox as one who has already passed through an attack of the disease.

During every epidemic of smallpox, more especially in the first few weeks of its course, a considerable number of more or less unprotected persons are brought into contact with others suffering from the disease, before the true nature of the illness is recognised. The question therefore arises, what degree of protection is afforded to such persons by prompt vaccination and revaccination. It is obviously impossible to determine how many persons escaped smallpox entirely, as the result of vaccination or revaccination performed during the first few days after exposure to the infection, and it is impossible to decide by means of hospital statistics alone, what proportion of contacts escaped in whom the operation was performed during the later days of the incubation period. Yet some information may be derived from a study of the number of cases admitted to Hospital who were vaccinated or revaccinated on the different days included within the period of incubation, and of the severity of the attack. In the following table an attempt is made to give some information regarding this question. This table deals with cases of revaccination only.

TABLE SHOWING, IN CASES SUCCESSFULLY REVACCINATED AFTER INFECTION, THE INFLUENCE OF THE REVACCINATION ON SEVERITY OF ATTACK.

Number of Days before Sickening.	Day of Incubation Period.	Discrete.		Confluent.	
		Cases.	Deaths.	Cases.	Deaths.
13 days	—	1	—	—	—
12 ,,	—	1	—	—	—
11 ,,	1st	—	—	—	—
10 ,,	2nd	1	—	—	—
9 ,,	3rd	4	—	—	—
8 ,,	4th	13	—	—	—
7 ,,	5th	11	—	1	—
6 ,,	6th	6	—	1	—
5 ,,	7th	17	—	3	1
4 ,,	8th	20	—	2	—
3 ,,	9th	7	—	4	2
2 ,,	10th	3	—	2	—
1 ,,	11th	11	—	2	—
Day of sickening	12th	6	—	4	3
		101[1]	—	19	6

When a person is in contact for several days with a case of smallpox, and subsequently contracts the disease, it is impossible to say at what particular moment he was attacked by the contagion, so that we are compelled, in discussing the question under consideration, to erect a standard, and though the period of incubation in smallpox is known to vary between eight and seventeen days, yet a period of incubation of twelve days is so common, that it seems permissible to select this term as our standard. In this table we have two cases vaccinated prior to the commencement of the twelve days' incubation period. These point, possibly, to thirteen or fourteen days' incubation, or they may be cases in which the vaccinal reaction was delayed after revaccination. For our present purpose it will be best to set these aside, and consider only those embraced within a twelve days' period. A glance at the table will shew that, during the first three days of our selected incubation period, only five cases occurred among the many hundreds of contacts who were revaccinated, and it is consequently reasonable to suppose that many others would have contracted the disease had they not been protected by prompt revaccination.

---

[1] Of these 83 were sparse and 18 abundant.

During the epidemic a great majority of the patients admitted to Hospital were certified on or before the fifth day of illness, and more exceptionally at a later period. As the number of contacts was presumably in direct proportion to the number of cases, it follows that the great majority of these were exposed to the infection for a period of five days or less; so that there must have been more contacts revaccinated after a short than after a long exposure to the infection, or, in other words, during the earliest days of the incubation period. Yet we find that of those revaccinated during the first three days of the incubation period, only five contracted smallpox, and all were mild cases. Twenty-five cases were admitted who had been revaccinated during the fourth and fifth days of the incubation period, and all were mild except one case revaccinated on its fifth day of incubation, and there were no deaths. Twenty-seven cases admitted had been revaccinated on the sixth and seventh days after exposure, and of these four were confluent and one died. Thirty-three cases were admitted who had been revaccinated on the eighth or ninth day of the incubation period, and of these six were confluent and two died. Twenty-eight cases were admitted after revaccination had been performed on one of the last three days of the incubation period, and of these eight were confluent and three died.

It will be seen, therefore, that though the number of contacts presumably becomes less as the period of exposure lengthens, the number of persons admitted to Hospital from among these contacts becomes almost progressively greater, the drop during the last three days of the incubation period being no doubt due to the fact that only a very small number of cases of smallpox were admitted to Hospital after being kept at home for so long a time as ten to twelve days.

The conclusions to be drawn from a study of this table are—First, that thorough and successful revaccination, performed during the first three days of the incubation period, affords an almost certain protection against the development of an incubating attack of smallpox; second, that successful and thorough revaccination during the fourth and fifth days, while it may not absolutely protect against smallpox, yet renders the attack, in most cases, of a comparatively trivial character; third, thorough and successful revaccination, performed during the sixth and seventh days of the incubation period, affords, if any, only a very modified protection, as out of twenty-seven cases four or 14·8 per cent. were confluent, while the case-mortality was one or 3·7 per cent; fourth, thorough and successful revaccination, performed during the last five days of the incubation period, seems to afford no protection of any kind, for of 61 persons who contracted the disease after revaccination during this period, 14 or 23 per cent. developed it in a confluent form, while the case-mortality was 5 or 8·2 per cent.

We have now to deal with the question whether primary vaccination, performed during the period of incubation, exercises the same influence in preventing or modifying an incubating attack of smallpox, as does revaccination performed during the same period. In the following table twenty-three cases are grouped together in which primary vaccination was performed after exposure to infection. It may be observed that, in a few of the cases represented here, there was doubt as to whether vaccination had been performed in infancy or not; but it has been thought legitimate to include these for our present purpose among those known to have been vaccinated for the first time during the period of incubation.

TABLE SHOWING, IN "UNVACCINATED" AND "DOUBTFUL" CASES VACCINATED AFTER INFECTION, THE INFLUENCE OF SUCH VACCINATION ON SEVERITY OF ATTACK.

Number of Days before Sickening.	Days of Incubation Period.	Discrete.		Confluent.	
		Cases.	Deaths.	Cases.	Deaths.
13 days	—	1	—	—	—
12 ,,	—	—	—	—	—
11 ,,	1st	—	—	—	—
10 ,,	2nd	—	—	—	—
9 ,,	3rd	3	—	1	1
8 ,,	4th	2	—	—	—
7 ,,	5th	2	—	1	—
6 ,,	6th	2	—	—	—
5 ,,	7th	1	1	2	1
4 ,,	8th	3	1	1	1
3 ,,	9th	—	—	—	—
2 ,,	10th	2	—	1	1
1 ,,	11th	—	—	1	1
Day of sickening,	12th	—	—	—	—
		16	2	7	5

XX.—*The Genealogy of MSS. and Texts, with especial reference to recent Chaucer Investigations.* By W. S. M'Cormick, M.A., LL.D.

[Read before the Historical and Philological Section, 3rd February, 1902.]

SUMMARY.

This was a close textual criticism of the currently received hypothesis of the canon of Chaucer as exemplified in the *Pardoner's Prologue and Tale*, and in particular of the position maintained by Zupitza and Koch that the earliest and best versions trace their descent from a member of the Ellesmere group of MSS. of the *Canterbury Tales.* A summary of so technical a contribution is impossible, but its purport was to show by a diversity of tests not only that the hypothesis under examination failed to explain divergent readings in MSS., hypothetically derivatives of the Ellesmere version, but that these divergent readings were sometimes quite as likely to represent the original form as those of the Ellesmere. Indeed, the contention was that Zupitza's whole argument rested on two assumptions which begged the question. These assumptions (1) that the Ellesmere group was correct where other groups were corrupt, and (2) that it represented Chaucer's *original* text uncorrected, were shewn to be improbable and unjustifiable, and a large variety of textual disproofs of them tended to support an entirely opposite interpretation of the place to be given to the Ellesmere group—a place due rather to later correction or alteration than to original purity of the readings.

XXI.—*Huchown of the Awle Ryale and His Poems, examined in the Light of Recent Criticism.*[1] By J. T. T. BROWN.

[Read before the Historical and Philological Section, 21st April, 1902.]

SUMMARY.

BEGINNING by noticing the group of alliterative poems written between 1350 and 1520, Mr. Brown directed attention more particularly to fifteen of these poems now claimed for the mysterious poet Huchown. Eight, he pointed out, had at one time or another, during the last sixty years, been frequently examined, the opinions of literary critics being widely divergent on both their age and authorship, but no one, until Mr Neilson raised the question, had ever suspected six of the remaining seven to be Scottish poems at all. He (Mr Brown) had never doubted the identity of Huchown and Sir Hew of Eglintoun—Dr David Laing's long note on Sir Hew of Eglintoun in his edition of Dunbar being quite explicit, although Mr Neilson's amplified calendar would certainly be helpful to critics who had hitherto doubted.

After pointing out that Mr Neilson, in order to establish his thesis, undertook to prove "unity and correlation, where others had failed or denied" and to apply a process of colligation which claimed (1) to associate resemblances and analogies with absolute proof of relation and indebtedness of substance and plot and incident and phrase between poem and poem; (2) to illustrate the repeated use of the same sources; (3) to trace the origins of many passages to the actual MS. the poet used; and (4) to point out, in the poet's own handwriting on the margins of the MS., the primal adumbration of future poetic concepts,—Mr Brown held that such a cumulative argument could only be thoroughly tested by analysis, and he proceeded to pass under review, one by one, the main facts brought forward in support of

---

[1] Printed *in extenso* in *The Scottish Antiquary*, July, 1902.

the new attributions. Taking the two Hunterian MSS. first, and examining them minutely, he said he was unable to see how, by any possibility, the one MS. or the other could he proved to be the actual MS. the poet used, or the marginalia and jottings to be in the poet's own handwriting. Not a scrap of writing being extant known to be in the handwriting of Sir Hew of Eglintoun, not even a signature, by which the doubtful and secondary test *comparatio literarum* might be applied, it seemed to him that, owing to defective data, it must for ever remain a problem admitting of no solution. The resemblances and agreements between the MSS. and two of the poems, the *Troy* and the *Alexander*, only showed that the poet or poets appear to have used a Latin text nearly related to that of the Hunterian MS. They helped in no manner of way to solve the question of authorship.

A close examination of the *Titus* and *Morte Arthure* followed, as well as of other points brought forward by Mr Neilson in support of his claims for Huchown, with most of which Mr Brown entirely disagreed. As the result of his examination, he denied that Huchown was entitled to any of the seven poems newly imported into the discussion by Mr Neilson, while not more than three of the remaining eight could, with any degree of probability, be attributed to the Scottish poet.

RULES GOVERNING THE COMPETITION FOR THE GRAHAM MEDAL.

1. The competition for the Graham Medal shall be under the authority and control of the Council of the Royal Philosophical Society of Glasgow, whose decision on all points connected therewith shall be final.

2. Each candidate shall forward to the Secretary of the Royal Philosophical Society of Glasgow, 207 Bath Street, Glasgow, on or before 14th March of the year in which the competition is held, a paper giving an account of an unpublished original research conducted by himself in any branch of chemical science.

3. The medal shall be awarded to the candidate whose research, in the opinion of the Council, or of the person or persons whom they may appoint to adjudicate in the matter, is of the highest merit, and most likely to aid in the advancement of chemical science.

4. The successful candidate shall read the paper, on account of which the medal is awarded, to the Royal Philosophical Society of Glasgow. The paper shall thereafter be published in the *Proceedings* of the Society, and its publication elsewhere shall not take place without the permission of the Council.

5. No award shall be made if, in the opinion of the Council, no candidate has contributed a paper of sufficient merit.

MINUTES OF SESSION.

1901-1902.

6th November, 1901.

The First Ordinary Meeting, for Session 1901-1902, of the Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 6th November, 1901, at eight o'clock.—The President, the Right Hon. Lord Blythswood, occupied the Chair.

1. The Hon. Secretary intimated that no Minute would be read, as that for the previous Meeting was published in the last issue of the *Proceedings*, and had been read and approved at the close of the Meeting itself.

2. Mr Edward Macbean and Mr James Murray were admitted to membership of the Society.

3. The President read the following letter :—

"SCOTTISH OFFICES, WHITEHALL, S.W.,
"*23rd August, 1901.*

"MY LORD,

"I have had the honour to lay before the King the application of the Philosophical Society of Glasgow made through your Lordship, soliciting permission for the Society to prefix the title 'Royal' to their designation.

"I have it in command to inform you that His Majesty was pleased to receive the petition in the most gracious manner, and to signify His Majesty's pleasure, that the Society, in respect of the near approach of the hundredth anniversary of its foundation, shall hereafter be known as the Royal Philosophical Society of Glasgow.

"I have the honour to be,
"MY LORD,
"Your Lordship's obedient Servant,
(Signed) "BALFOUR OF BURLEIGH.

"The Right Honourable LORD BLYTHSWOOD,
"2 Seamore Place,
"Mayfair."

Lord Blythswood stated to the Meeting that it was necessary by the Articles of Constitution to formally move that the title "Royal" be assumed by the Society, and he had the greatest pleasure in submitting this motion.

The motion was accepted with acclamation.

4. The Chairman then introduced Professor Arthur Schuster, F.R.S., who delivered a lecture on "The Evolution of Solar Stars." A number of celestial photographs were shown in illustration of the lecture.

5. A hearty vote of thanks was accorded to the Lecturer on the motion of the President.

6. The Meeting appointed Mr Borthwick, and Mr Hanbidge to audit the Hon. Treasurer's books.

7. The following gentlemen were elected Members of the Society:—

Corresponding Member.

Professor EDMUND J. MILLS, D.Sc., LL.D., F.R.S.

Ordinary Members.

1. ALEXANDER GRAY, Manufacturer, Elmworth, Port-Glasgow.
2. JAMES GUTHRIE, R.S.A., 7 Woodside Place.
3. FRED. G. MACKILLOP, M.A., LL.B., 128 St. Vincent Street.
4. FREDERICK LARKINS MACLEOD, Merchant, 21 Huntly Gardens, Hillhead.
5. CHARLES SELLAR, B.L., Writer, 65 Bath Street.
6. W. M'WHIRTER, Electrical Engineer, 9 Walworth Terrace.

8. Dr Fergus proposed that the meeting take the opportunity of thanking Lord Blythswood for the services he had rendered to the Society during his tenure of office, as this was probably the last occasion for some time to come on which they would have His Lordship among them as President. The proposal was cordially responded to.

REPORT OF COUNCIL FOR SESSION 1900-1901.

I. The past Session was, in many respects, one of unusual activity. The papers read at meetings of the Society were above the average in number, and fully maintained the standard of previous years, both in point of general interest and treatment of subject, while several were of high value as increments to scientific knowledge.

II. The near approach of the Centenary of the foundation of the Society urged on the attention of the Council the importance of including in the Membership many prominent men in the West of Scotland and elsewhere, who were eligible for election, with the result that a large number of very desirable names were added to the Roll during the past Session.

III. The Council has for some time been moving to obtain for the Society some external mark of Royal favour, in recognition of the services which the Society has, during nearly one hundred years, rendered in the cause of scientific advancement. Through the agency and influence of the President, Lord Blythswood, the object of the Council has at length been accomplished. The title "Royal" will, therefore, by command of His Majesty the King, be prefixed to the orginal designation of the Society as soon as certain preliminary steps have been taken.

IV. *Sections.*—These have not, for many years, if ever, been in a more flourishing condition. Meetings for sectional papers and discussions were frequent throughout the session, and an endeavour is being made by some to follow the example of the Architectural Section in issuing early in the session a Syllabus of Work. The papers provided for the general meetings of the Society may be taken as indicating the quality of the work being done by the various sections, as very nearly all these papers were contributions from one or other section, quite independent of those read at sectional meetings.

V. *Proceedings.*—It was deemed inadvisable this year to issue the *Proceedings* (Vol. XXXII.), till near the beginning of the new session, and the volume consequently was not placed in the hands of members until the middle of October. Most of the papers read before meetings of the Society last session are included, and others are retained by their authors for fuller treatment.

VI. The competition for the Graham Medal was advertised in the usual way, but no papers were offered.

VII. During the summer the University of Glasgow celebrated its ninth Jubilee, and the Society was invited to send delegates to take part in the celebrations. The Council commissioned the President and the Hon. Secretary to represent the Society; and a congratulatory address to the University having been drawn up in the name of the Society, was presented by the delegates.

VIII.—*Membership.*—At the beginning of the Session there were 626 Ordinary Members on the roll. During the Session 365 Members were elected, 7 of whom, however, did not pay entry-money—and 2 reinstated from the Suspense List, making a total of 986. Of these 1 has resigned, 6 have died, 1 has been placed on the Suspense List, and 2 have been struck off the roll for non-payment of subscription, so that at the beginning of Session 1901-1902 there were 976 Ordinary Members on the Society's list. Amongst those who have died we notice the names of Mr Alex. A. Ferguson, Dr Stevenson Macadam, a Corresponding Member, and Mr Henry Ross. Of the new Members admitted during the Session, 98 qualified themselves as Life Members. There are now 255 Members of that class out of 293 who have so enrolled themselves. The roll now includes 16 Honorary Members, 9 Corresponding Members, and 976 Ordinary Members, (Annual and Life), or a total of 1,001.

IX. *Finance.*—The Treasurer's statement for 1900-1901 opens with a balance of £14 13s. 7d. due to him, against which there was an investment in railway stock of £47 9s., the remainder at cost, of a larger investment partly sold. The accounts close with £16 1s. 11½ in Treasurer's hands with the same investment and £150 deposited with the Corporation of Glasgow. The remainder, £1,200, of the Society's one half of the Heritable Bond over the joint property, 207 Bath Street, was paid off in May last. It is believed that, as usual at the close of the financial year, the Society has practically no outstanding liability.

Separate statements are given by the Treasurer, as formerly, showing the position of the two funds which the Society holds in trust, viz.:—"The Graham Medal and Lecture Fund" and "The Glasgow Science Lecture Fund," the balances of revenue being £49 17s. 10d. and £27 9s. 6d. respectively.

By Order and in Name of the Council,

(Signed) FREELAND FERGUS,
Honorary Secretary.
PETER BENNETT,
Acting Secretary.

REPORT OF THE LIBRARY COMMITTEE.

The Library Committee have to report that during last year 883 books and 611 periodicals were issued to members by the Librarian. Consultations of books were numerous and much use was made of the Reading Room.

There were added to the Library by purchase, 89 volumes, and 6 parts of works, and 55 volumes, 22 parts, and 18 pamphlets were presented.

The periodicals at present received at the Library number 103, of which 42 are presented or received in exchange, and 61 are bought. These form 95 volumes yearly.

The *Proceedings* of the Society were sent to 178 Societies and Public Departments, and 152 volumes and 144 parts of works were received in exchange.

Altogether during the year there have been added to the Library 184 volumes by purchase, 152 by exchange, and 55 have been presented, making an estimated total of 14,159 volumes, exclusive of pamphlets of which there are many hundreds.

Since last report, 261 volumes have been bound.

The Australian Association for the Advancement of Science, the Australian Museum (Sydney), the Western Society of Engineers, Chicago, the Ohio State University, the United States Department of Agriculture, the United States Geographical Survey, the Volta Bureau (Washington), the American Association for the Advancement of Science, and the University of Missouri, have been added to the list of exchanges.

Every effort is being made to have the new catalogue in the hands of the printer early in next year.

JOHN ROBERTSON, HON. LIBRARIAN,
Convener.

20th November, 1901.

The Annual Business Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 20th November, 1901, at eight o'clock. Mr. William Ewing was called to the Chair.

1. The Minute of previous Meeting, of date 6th November, 1901, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The New Members elected at the previous Meeting were duly admitted.

3. The Annual Report of the Council was presented by the Honorary Secretary, Dr Freeland Fergus, and was adopted on his motion.

4. In the absence of the Honorary Treasurer, Mr John Mann, Jun., presented the Annual Financial Statement, signed by Mr Jas E. Hanbidge and Mr Jas D. Borthwick, Auditors, which, on the motion of the Chairman, was adopted.

5. The Honorary Librarian, Mr Robertson, in presenting the Library Committee's Annual Report, made reference to the New Catalogue in course of preparation, to the increase in the number of readers, and to the special value of some recent additions to the Library. The Report was adopted, and a vote of thanks accorded to donors of books, etc.

6. The Chairman proposed Professor Barr as President, in succession to Lord Blythswood, whose term of office had expired, and referred in eulogistic terms to the services of His Lordship and the progress of the Society during his occupancy of the Presidential chair. The motion was unanimously agreed to.

7. The Chairman proposed Professor Magnus Maclean as Vice-President, in room of Dr Rottenburg. The motion was unanimously agreed to.

8. On the motion of the Chairman—Mr John Robertson, Mr John Mann, C.A., and Dr Freeland Fergus, were unanimously re-elected Honorary Librarian, Honorary Treasurer, and Honorary Secretary, respectively, and a vote of thanks for their past services was accorded to them.

9. On the motion of the Chairman—Mr A. M. Lindsay, Dr James Finlayson, Mr James Knight, and Mr Gilbert Thomson, were elected Members of Council.

10. On the motion of the Chairman, Mr H. A. Mavor was elected to the Membership of Council, in room of Professor Elliot, who had resigned on account of pressure of other business.

11. Office-bearers for the different sections (see pp. 341, 342) were proposed respectively as below, and unanimously elected:—

(*a*) For the Geographical and Ethnological Section—The Chairman proposed those on list, p. 342.

(*b*) For the Sanitary and Social Economy Section—Mr Wm Buchanan proposed those on list, p. 341.

(*c*) For the Mathematical and Physical Section—Mr R. F. Muirhead proposed those on list, page 342.

(*d*) For the Economic Science Section—Mr John Mann, Jun., proposed those on list, p. 342.

(*e*) For the Historical and Philological Section—Mr John Clark proposed those on list, p. 342.

Dr.

ABSTRACT OF HONORARY TREASURER'S
AND COMPARISON WITH

			1900-1901.	*1899-1900.*
			£ s. d.	£ s. d.
To Balance from last year— Investment, Caledonian Railway £110, 3 per cent. Preferred, Converted, - - - - - - -			47 9 0	*47 9 0*
,, Subscriptions to 31st October, 1901—				
357 Entry-moneys of 1900-1901, at 21s.,		£374 17 0		
Annual Dues at 21s.—				
Arrears, - - - - -	£3 3 0			
For 1900-1901, 455 Ordinary Members, - - -	477 15 0			
Do., 258 New Members, -	270 18 0			
		751 16 0		
Life Subscriptions at £10 10s.—				
1 Old Member, - -	£10 10 0			
98 New Members, -	1029 0 0			
		1039 10 0		
			2,166 3 0	*619 10 0*
,, Dividends on Investment—				
Caledonian Railway, April, 1901, less Tax,		£1 11 4		
,, ,, Oct., ,, ,,		1 11 2		
			3 2 6	*3 3 5*
,, General Receipts—				
Bank Interest, - - - - -		£15 12 11		
Proceedings, etc., sold, - - -		1 4 7½		
			16 17 6½	*10 3 4*
,, Architectural Section— 79 Associates' fees at 5s., - - - - - - -			19 15 0	*22 10 0*
,, Mathematical and Physical Section— 1 Associate's fee, - - - - - - - -			0 5 0	*0 0 0*
,, Economic Science Section— 19 Associates' fees at 5s., - - - - - -			4 15 0	*2 15 0*
,, Geographical and Ethnological Section— 6 Associates' fees at 5s., - - - - - - -			1 10 0	*3 10 0*
,, Philological Section— 2 Associates' fees at 5s., - - - - - - -			0 10 0	*0 0 0*
,, Balance due to Treasurer, - - - - - -			0 0 0	*14 13 7*
			2,260 7 0½	*723 14 4*

Memo.—The Society's Investments are—

(1) Bath Street Joint Buildings, as in last Account, - - - - (Bond now paid off).	£3,933 7 4½
(2) Caledonian Railway Stock, as above (present value, £89 13s.), -	47 9 0
(3) Deposit with Corporation of Glasgow, - - - - - -	150 0 0
	£4,130 16 4½

ACCOUNT—SESSION 1900-1901. *Cr.*

SESSION 1899-1900.

				1900-1901.			*1899-1900.*		
				£	s.	d.	*£*	*s.*	*d.*
By Balance from last year—due to Treasurer,				14	13	7	*87*	*11*	*2*
,, General Expenditure to 31st October, 1901—									
Ex-Secretary's retiring allowance (4th year),	£35	0	0						
Remuneration to Acting Secretary, -	65	0	0						
Extra allowances to ,, -	11	11	0						
Allowance for Treasurer's Clerks, - -	15	0	0						
Commission to Collector, - - -	5	18	7						
				132	9	7	*110*	*10*	*3*
,, New Books and Periodicals, British and Foreign, - - - - - - -	£115	11	4						
Bookbinding, - - - - - -	19	12	8						
Printing Circulars, *Proceedings*, etc., -	210	8	10						
Postage and delivery of circulars, letters, etc.,	36	12	3						
Stationery, etc., - - - - - -	29	18	9						
Illuminated Address to the University, -	6	6	0						
				418	9	10	*319*	*8*	*0*
,, Fire Insurance on Library for £5,400, -	£6	10	0						
Postages, etc.—Per Secretaries, £6 17s. 11d.; per Treasurer, £6 7s. 7½d., - -	13	5	6½						
				19	15	6½	*12*	*11*	*11½*
,, Joint Expenses of Rooms—Society's half of £501 7s. 6½d., being Improvements, Repairs, Insurance, Taxes, Cleaning, Lighting, Heating, Salaries of Curator and Assistant, and Expense of Discharging Bond; also Interest on Bond, £37 1s.; less half of £83 5s., Revenue from Letting, - - - -				246	2	3½	*130*	*13*	*10½*
,, Balance of Bond over property paid up, - - -				1,200	0	0	*0*	*0*	*0*
,, Subscriptions to Societies—									
Ray Society, 1901, - - - - -	£1	1	0						
Palæontographical Society, 1901, -	1	1	0						
				2	2	0	*2*	*2*	*0*
,, Architectural Section— Expenses per Treasurer of Section, - - - -				8	14	6	*11*	*19*	*1*
,, Economic Science Section— Expenses per Secretary of Section, - - - -				3	18	3	*0*	*11*	*0*
,, Geographical and Ethnological Section— Expenses per Treasurer of Section, - - - -				0	6	0	*0*	*12*	*6*
,, Mathematical and Physical Section— Expenses per Secretary of Section, - - - -				0	3	0	*0*	*4*	*0*
,, Philological Section— Expenses per Treasurer of Section, - - - -				0	1	6	*0*	*1*	*6*
,, Investments—									
Caledonian Railway £110, 3 per cent. Preferred, Converted (Balance),	£47	9	0						
Corporation of Glasgow, on Deposit,	150	0	0						
				197	9	0	*47*	*9*	*0*
,, Balance in Treasurer's hands, - - - - -				16	1	11½	*0*	*0*	*0*
				2,260	7	0½	*723*	*14*	*4*

Glasgow, 14th November, 1901.—We, the Auditors appointed by the Society to examine the Treasurer's Accounts for the year 1900-1901, have examined the same, of which the above is an Abstract, and have found them correct, the Balance in Treasurer's hands being Sixteen Pounds, One Shilling and Elevenpence Halfpenny Sterling.

(Signed) JAS. E. HANBIDGE.
JNO. MANN, C.A., *Honorary Treasurer.* JAS. D. BORTHWICK.

GRAHAM MEDAL AND LECTURE FUND.

ABSTRACT OF TREASURER'S ACCOUNT, Session 1900-1901.

Dr.

CAPITAL AT 1st NOVEMBER, 1900—		
Glasgow and South-Western Railway Co. 4 Per Cent. Preference Stock in name of the Philosophical Society, in Trust,	£250 0 0	
Value of Die at H.M. Mint,	18 18 0	
		£268 18 0
Cash in Bank,		39 10 4
REVENUE—		
Dividend, March, 1901, less Tax,	£4 15 0	
,, Sept., ,, ,,	4 14 6	
Interest from Bank,	0 18 0	
		10 7 6
		£318 15 10

Cr.

CAPITAL AT 31st OCTOBER, 1901—		
Investment, *per contra*,	£250 0 0	
Die,	18 18 0	
		£268 18 0
BALANCE, BEING REVENUE—		
In Bank, on Deposit Receipts,		49 17 10
		£318 15 10

GLASGOW, 14th November, 1901.—Examined and found correct.

(Signed) JAS. E. HANBIDGE.
JAS. D. BORTHWICK.

JNO. MANN, C.A., *Honorary Treasurer*.

THE SCIENCE LECTURES ASSOCIATION FUND.

Dr. ABSTRACT OF TREASURER'S ACCOUNT—Session 1900-1901. *Cr.*

Dr.		
Capital at 1st November, 1900—		
£200 Caledonian Railway Company 4 Per Cent. Preference Stock, No. 1, in name of the Philosophical Society, in Trust, cost,	£244 4 8	
On Deposit Receipt,	8 5 4	
		£252 10 0
Cash in Bank (Revenue),		19 5 7
Revenue—		
Dividend, April 1901, less Tax,	£3 16 0	
,, Oct., ,, ..	3 15 7	
Interest from Bank,	0 12 4	
		8 3 11
		£279 19 6

Cr.		
Capital at 31st October, 1901—		
Investment, *per contra*,	£244 4 8	
In Bank, on Deposit Receipt,	8 5 4	
		£252 10 0
Balance, being Revenue—		
In Bank, on Deposit Receipt,		27 9 6
		£279 19 6

Glasgow, 14th November, 1901.—Examined and found correct.

(Signed) JAS. E. HANBIDGE.
JAS. D. BORTHWICK.

JNO. MANN, C.A., *Honorary Treasurer.*

12. A vote of thanks was accorded to the auditors, Mr Jas E. Hanbidge and Mr Jas D. Borthwick, on the motion of Mr John Mann, Jun.

13. It was agreed on the motion of Mr George Neilson, seconded by Mr John Clark, "That the name of the Philological Section be changed to the Historical and Philological Section, and that it be remitted to the Council of the Society to make such alterations in the Constitution of the Section as may be necessary."

The Hon. Secretary explained that in terms of the Constitution, this motion must be again made at next meeting.

The business of the Ordinary Meeting was then proceeded with.

14. Mr James Knight, M.A., B.Sc., etc., read a paper on "The Training of Teachers in Scotland."

Discussion followed, in which part was taken by Mr Scougal, Mr M'Callum, Mr John Clark, Mr Cowen, Mr Samuel, Miss Galloway, Mr John Mann, Jun., and Mr Buchanan.

Mr. Knight replied, and, on the motion of the Chairman, was accorded a hearty vote of thanks for his paper.

15. The Hon. Secretary announced that the following gentlemen had been duly elected Members of the Society :—

1. JOHN DOUGLAS BROWNLIE, M.B., Ch.B., L.D.S., 10 Brandon Place.
2. GEORGE DOUGLAS BUCHANAN, Fairholm, Giffnock.
3. Dr WALKER DOWNIE, 4 Woodside Crescent.
4. JOHN C. HARRINGTON, 14 Queen's Gate, Dowanhill.
5. MALCOLM LAURIE, B A., D.SC., F.L.S., Professor of Zoology (St Mungo's College), Clunaline, Lenzie.
6. JAMES STEEL, M.A., Property Agent, 502 St Vincent Street.
7. R. S. THOMSON, M.D., D.SC., Professor of Medicine (Anderson's Medical College), 3 Melrose Street.
8. JOSEPH J. ELLIOTT, City Chambers.
9. Prof. DUDLEY J. MEDLEY, M.A., of the University, 6 University Gardens.

4th December, 1901.

The Third Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 4th December, 1901, at eight o'clock.—The President, Professor A. Barr, occupied the Chair.

1. The Minute of previous Meeting, of date 20th November, 1901, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The Chairman thanked the Society for having conferred on him the highest honour in their power by electing him their President.

3. The Members elected at the previous Meeting were duly admitted.

4. It was moved by Mr George Neilson, seconded by Mr John Clark, and unanimously agreed "That the name of the Philological Section be changed to the Historical and Philological Section, and that it be remitted to the Council of the Society to make such alterations in the Constitution of the Section as may be necessary."

The President declared the motion to be now the finding of the Society, having received the assent of two consecutive meetings.

5. Professor John Ferguson, of Glasgow University, then read a paper on "Joannes Matthæus and his Tract on the History of Inventions." On the motion of the President, Prof. Ferguson received the cordial thanks of the Meeting.

6. Mr H. Stanley Allen, M.A., B.Sc., read a paper on "The Photography of Sound Waves, and other Disturbances in Air," being a contribution from the Mathematical and Physical Section. A large number of photographs of Sound Waves and of Air in states of disturbance from other causes were thrown on the screen.

Professor Gray, Professor Blyth, and Mr Falconer took part in the discussion which followed.

Mr Allen replied, and on the motion of the Chairman was accorded a hearty vote of thanks for his communication.

7. The President announced that the following gentlemen had been duly elected Members of the Society :—

Corresponding Member.

Professor ARTHUR SCHUSTER, PH.D., F.R.S.

Ordinary Members.

1. **James Spencer Anderson**, 81 Great Clyde Street.
2. **Thomas Ewan**, M.Sc., Ph.D., 30 Lansdowne Crescent.
3. **James Fairlie Gemmill**, M.A., M.D., Lecturer in Embryology, University of Glasgow.

18th December, 1901.

The Fourth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 18th December, 1901, at eight o'clock.—The President, Professor A. Barr, occupied the Chair, and was supported by Mr Wm Ewing, President of the Geographical and Ethnological Section.

1. The Minute of previous Meeting, of date 4th December, 1901, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The President introduced Major Frank Johnson who delivered a lecture on "Rhodesia, its Present and Future," being a contribution from the Geographical and Ethnological Section. Numerous illustrations from photographs taken in Rhodesia were thrown on the screen.

Mr Ewing and the President spoke in commendation of the lecture, and Major Johnson received the hearty thanks of the Meeting.

3. The President announced that the following gentlemen had been duly elected Members of the Society:—

1. **John Gunn**, B.L., Solicitor, 37 Bath Street.
2. **James A. Macdonald**, H.M. Inspector of Schools, 23 Doune Terrace.
3. **A. D. Miller**, H.M. Inspector of Schools, 20 Wilson Street, Hillhead.
4. **Hugh Millar**, M.A., Teacher, 3 Westminster Terrace, Ibrox.
5. **Thomas Hodgson Miller**, Manufacturer, 17 Bute Gardens, Hillhead.
6. **George Smith Orr**, Writer, 58 Renfield Street.
7. **James Smellie**, I.M., Measurer, 112 Bath Street.
8. Professor **Walter Raleigh**, M.A., of Glasgow University, 2 South Park Terrace.

8th January, 1902.

The Fifth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 8th January, 1902, at eight o'clock.—In the absence of the President of the Society Mr John Mann, Jun., President of the Economic Science section, occupied the Chair.

1. The Minute of previous Meeting, of date 18th December, 1901, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The New Members elected at the previous Meeting were duly admitted.

3. The Chairman introduced Mr W. W. Carlile, M.A, who read a paper on "The Relation of Economics to Numismatics." In the discussion which followed, Mr Cree, Mr George Neilson, Mr Macdonald, Mr Blyth, and the Chairman, took part. Mr Carlile replied, and on the Chairman's motion, was accorded the hearty thanks of the Meeting.

4. Mr Thomas Jones, M.A., was next introduced by the Chairman, and read a paper entitled, "Notes on the Employment of Women in the Printing Trade."

Mr Cree, Mr John A. Todd, the Chairman, and Mr Jones, took part in the discussion which followed. A hearty vote of thanks was accorded to Mr Jones on the motion of the Chairman.

The above papers were contributed by the Economic Science Section.

5. The Chairman announced that the following gentlemen had been duly elected Members of the Society:—

1. HUGH M'CALLUM, M.A., Shields Road School.
2. JAMES D. G. DALRYMPLE, F.S.A., Meiklewood, Stirling.
3. FRANK W. YOUNG, H.M. Inspector of Schools, 32 Buckingham Terrace.
4. ALEXANDER KENNEDY, Kenmill House, Bothwell.

22nd January, 1902.

The Sixth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 22nd January, 1902, at eight o'clock.—In the absence of the President of the Society Mr George Neilson, President of the Historical and Philological Section, occupied the Chair.

1. The Minute of previous Meeting, of date 8th January, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The New Members elected at the previous Meeting were duly admitted.

3. The Chairman introduced Professor Dudley J. Medley, of Glasgow University, who read a paper entitled, "Under-Currents of Mediæval Life," being a contribution from the Historical and Philological Section.

A long discussion followed in which part was taken by Dr Colville, Mr Edwards, Mr J. Clark, Dr Frew, Dr Fergus, and the Chairman. Prof. Medley replied.

On the motion of the Chairman a hearty vote of thanks was passed to Prof. Medley.

4. The Chairman announced that the following gentlemen had been duly elected Members of the Society.

1. JAMES SCOTT ANDERSON, Auchnasith, Bearsden.
2. SAMUEL STEVENSON, 4 Royal Terrace, Crosshill
3. WILLIAM TAIT, 43 Keir Street, Pollokshields.

5th February, 1902.

The Seventh Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 5th February, 1902, at eight o'clock.—The President of the Society, Professor A. Barr, occupied the Chair, and was supported by Dr A. K. Chalmers, President of the Sanitary and Social Economy Section, and Mr James Chalmers, President of the Architectural Section.

1. The Minute of previous Meeting, of date 22nd January, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The New Members elected at the previous Meeting were duly admitted.

3. The Chairman introduced Mr Ebenezer Howard, London, who delivered a lecture on "Garden Cities," illustrated by a number of lime-light views. The lecture was a joint communication from the Sanitary and Social Economy Section and the Architectural Section.

A long discussion followed in which part was taken by Lieut.-Colonel Smith Park, Mr James Chalmers, Dr A. K. Chalmers, Mr John Mann, Jr., Councillor Steele, Mr M'Lagan, Dr Frew, Mr Paul, Mr A. S. Mories, Mr Geo. Neilson, and the President.

Mr Howard replied, and received the hearty thanks of the Meeting on the motion of the Chairman.

19th February, 1902.

The Eighth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 19th February, 1902, at eight o'clock.—In the absence of the President of the Society Professor Ferguson, Hon. Vice-President, occupied the Chair.

1. The Minute of previous Meeting, of date 5th February, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. Dr R. M. Buchanan, Bacteriologist to the Corporation, read a paper entitled "Plague in some of its Historical and Present Day Aspects," with lantern illustrations.

Dr Workman and Dr Buchanan discussed some questions springing from the subject treated.

Dr Buchanan was accorded a hearty vote of thanks on the motion of the Chairman.

3. Dr James F. Gemmill, Lecturer on Embryology, Glasgow University, read a paper, illustrated by drawings and views, entitled, "On the Biological Interest of Abnormalities."

On the motion of the Chairman, Dr Gemmill was accorded the hearty thanks of the Meeting.

5th March, 1902.

The Ninth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 5th March, 1902, at eight o'clock.—In the absence of the President of the Society Professor Gray, President of the Mathematical and Physical Section, occupied the Chair.

1. The Minute of previous Meeting, of date 19th February, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The Chairman intimated an apology for absence from the President. An apology for absence was also sent by Professor Maclean.

3. Mr R. F. Muirhead, M.A., B.Sc., Secretary of the Mathematical and Physical Section, exhibited and described a model showing the Classification of Consonantal Sounds.

Mr Clark and Mr Knight took part in a discussion which followed. Mr Muirhead replied, and was accorded a hearty vote of thanks on the motion of the Chairman.

4. The Chairman introduced Mr J. W. Peck, M.A., who then read a paper on "Thermal Emissivity." A discussion ensued, in which part was taken by Professor Blyth, Mr H. Mavor, Mr M'Laurin, and Professor Gray.

On the Chairman's motion, Mr Peck received the hearty thanks of the Meeting.

5. Professor Gray then made a short communication on "Observations on Energy in a Magnetic Field."

Professor Blyth moved a hearty vote of thanks to Prof. Gray, which was seconded by Dr Fergus, and received a cordial response.

All the foregoing papers were contributed by the Mathematical and Physical Section.

6. The Hon. Secretary read the Constitution of the Historical and Philological Section, as amended by the Council under remit from Meetings of the Society of dates 20th November and 4th December, 1901.

CONSTITUTION OF THE HISTORICAL AND PHILOLOGICAL SECTION.

(1) The Section shall be called the HISTORICAL AND PHILOLOGICAL SECTION.

(2) The object of the Section shall be to aid the advancement of History and Philology by affording opportunities for the discussion of subjects related thereto, to be introduced by the reading of papers or by verbal communication. The papers may also be read before the Society, according as the Council of the Section may see fit to recommend to the Council of the Society.

(3) The Section shall consist of Members of the Royal Philosophical Society, who are to be admitted free to its meetings, and of Associates who are not Members of the Society, but shall be admitted to the Section on payment of an Annual Subscription of Five Shillings. Associates shall have the privilege of attending not only the meetings of the Section, but also those of the Society at which the Section's papers are read and discussed, and also of consulting the books in the Library.

(4) The management of the Section shall devolve upon a Council, consisting of a President, two Vice-Presidents, a Secretary (who shall also act as Treasurer), and thirteen other Members.

(5) The Secretary shall be elected annually. After the first year four Members of Council shall retire annually in rotation, the order to be determined by ballot on the first occasion of an election. Retiring Members shall be eligible for re-election. Three shall be a quorum.

(6) The Office-bearers of the Section shall be elected by the Society at its Annual Business Meeting.

(7) Vacancies occurring during the currency of a year may be filled up, *ad interim*, by the Council of the Section, if they deem it expedient.

(8) The Council of the Section shall report annually to the Society.

(9) No paper shall be read that has not been approved by the Council of the Section; and copies of the papers shall be given into the charge of the Secretary of the Section at the close of the meeting at which they have been read.

(10) Associates shall be elected by the Council of the Section at any of its meetings. Each Candidate shall be recommended by two Members or Associates. The vote shall be by ballot, a majority deciding.

(11) The Associates' Annual Subscription shall become due on the First day of November in each year.

(12) No alteration shall be made upon the foregoing without the consent of the Society at two successive ordinary meetings.

7. The Hon. Secretary announced that the following gentlemen had been duly elected Members of the Society:—

Corresponding Member.

W. S. M'CORMICK, M.A.

Ordinary Members.

1. JAMES LEIPPER, 12 Park Drive, Whiteinch.
2. ANDREW H. PETTIGREW, Chesters, Bearsden.
3. ANDREW DRUMMOND DUTHIE, 2 Rothesay Gardens, Partickhill.

19th March, 1902.

The Tenth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 19th March, 1902, at eight o'clock.—The President of the Society, Professor Barr, occupied the Chair.

1. The Minute of previous Meeting, of date 5th March, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The new Members elected at last meeting were admitted.

3. The Chairman read apologies for absence from the Hon. The Lord Provost, Bailie Stevenson, and Mr Peter Fyfe.

4. The Chairman called upon Professor Smart to open, according to arrangement, a discussion on "Housing Problems." The discussion was a contribution from the Economic Science Section, and was confined to the consideration of the question, viz. :—For

what class is there an acute housing problem, and should that problem be dealt with by either (*a*) Philanthropic Enterprise, (*b*) The Municipality, or (*c*) Philanthropic or Semi-Philanthropic Associations?

Mr Shaw Maxwell, Mr Scott, Mr Motion, Mr Todd, Mr H. Mavor, Dr John M'Vail, Mr Eadie, Ex-Bailie Mayberry, Mr John Mann, jun., Mr J. Findlay, jun., Mr Kelly, Mr Kennedy, and the President, took part in the discussion.

On the motion of the Chairman, Professor Smart was accorded the thanks of the Meeting.

5. The President announced that Mr Robert Jackson, 16 Dixon Avenue, Crosshill, had been duly elected to the Membership of the Society.

2nd April, 1902.

The Eleventh Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 2nd April, 1902, at eight o'clock.—The President of the Society, Professor Barr, occupied the Chair, and was supported by Dr A. K. Chalmers, President of the Sanitary and Social Economy Section.

1. The Minute of previous Meeting, of date 5th March, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The new Member elected at last meeting was admitted.

3. A paper by Professor R. S. Thomson, M D., D.Sc., and Dr Robert Fullarton, M.A., entitled "A Summary of the Statistics regarding Smallpox and Vaccination in cases admitted to the City of Glasgow Smallpox Hospital, Belvidere, between 10th April, 1900, and 30th June, 1901," was read by Dr Fullarton, and supplemented by observations from Professor Thomson.

The paper was a communication from the Sanitary and Social Economy Section.

A discussion followed, in which part was taken by Dr Chalmers, Professor Glaister, Mr Muirhead, Dr Brownlee, Dr Fergus, Mr M'Kellar, Mr M'Laurin, Mr Buchanan, Dr Snodgrass and Mr Martin.

Professor Thomson replied.

On the motion of the Chairman, a hearty vote of thanks was accorded to the authors of the paper.

4. The President announced that Mr David Corrie, F.C.S., "Nobels," Polmont Station, had been duly elected a Member of the Society.

16th April, 1902.

The Twelfth Ordinary Meeting, for Session 1901-1902, of the Royal Philosophical Society of Glasgow, was held within the Rooms, 207 Bath Street, on the evening of Wednesday, 16th April, 1902, at eight o'clock. In the absence of the President of the Society, Professor Barr, Mr Geo. Neilson, President of the Historical and Philological Section, occupied the Chair.

1. The Minute of previous Meeting, of date, 2nd April, 1902, having been printed in the Billet calling the Meeting, was held as read, was approved, and was signed by the Chairman.

2. The new Member elected at last meeting was admitted.

3. The Chairman introduced Professor Walter Raleigh, M.A., who read a paper entitled, "Early Collections of the Lives of English Poets."

The paper was a contribution from the Historical and Philological Section.

The reading of the paper was followed by appreciative remarks from Dr Colville, Mr John Clark, Mr Gifford, and the Chairman.

On the motion of the Chairman, Prof. Raleigh received the hearty thanks of the Meeting. Prof. Raleigh replied.

4. The Chairman annouced that Mr Robert Hart, Distiller and Wine Merchant, 8 Greenlaw Avenue, Paisley, had been duly elected a Member of the Society.

5. The Acting Secretary then read this Minute, which was approved, and the Chairman was authorised by the Meeting to sign it when engrossed in the Minute Book.

OFFICE-BEARERS
OF THE
Royal Philosophical Society of Glasgow.

SESSION 1901-1902.

President.

Professor Archibald Barr, D.Sc.

Vice-Presidents.

* John F. Campbell.
Professor John Glaister, M.D., F.R.S.E.
Professor Magnus Maclean, M.A., D.Sc., F.R.S.E.

Honorary Vice-Presidents.

The Right Hon. Lord Kelvin, G.C.V.O., LL.D., D.C.L., F.R.S., Foreign Associate of the Institute of France, President R.S.E., and Member of the Prussian Order *Pour le Mérite.*
James B. Russell, B.A., LL.D., M.D.
Professor John Gray M'Kendrick, M.D., LL.D., F.R.S., F.R.S.E., F.R.C.P.E.
Professor John Ferguson, M.A., LL.D., F.R.S.E., F.C.S., F.S.A. F.S.A.Scot.
Ebenezer Duncan, M.D., F.F.P.S.G.
The Right Honourable Lord Blythswood, LL.D.

John Robertson, *Hon. Librarian.*
John Mann, C.A., *Hon. Treasurer.*
Freeland Fergus, M.D., F.R.S.E., *Hon. Secretary.*

Presidents of Sections.

James Chalmers, I.A., *Architectural Section.*
A. K. Chalmers, M.D., *Sanitary and Social Economy Section.*
Wm. Ewing, *Geographical and Ethnological Section.*
Professor Andrew Gray, LL.D., F.R.S., *Mathematical and Physical Section.*
John Mann, Jun., M.A., C.A., *Economic Science Section.*
George Neilson, *Historical and Philological Section.*

Other Members of Council.

* Professor W. Smart, LL.D.
* Henry A. Mavor.
* Robert Goodwin, C.E.
* The Rt. Hon. Lord Inverclyde.
* John G. Kerr, LL.D.
John Macintyre, M.B.
H. F. Stockdale.
William S. Curphey.
A. M. Lindsay, M.A.
James Finlayson, M.D.
James Knight, M.A., B.Sc.
Gilbert Thomson, C.E., M.A.

Professor Peter Bennett, *Acting Secretary.*

---

* *Retire by rotation in November, 1902.*

OFFICE-BEARERS OF SECTIONS, 1901-1902.

Architectural Section.

President.

James Chalmers, I.A., Architect.

Vice-Presidents.

Ninian MacWhannell, I.A., Architect.
John L. Duncan, Decorator.

Hon. Secretary.

Alexander Gardner, Architect, 209 St. Vincent Street.

Hon. Treasurer.

William Howatt, I.M., Measurer, 146 Buchanan Street.

Honorary Members of Council.

A. Lindsay Miller, Architect.
David Thomson, I.A., Architect.
James Thomson, F.R.I.B.A., I.A., Architect.
Campbell Douglas, F.R.I.B.A., I.A., Architect.
Alex. Muir, Builder.
R. A. MacGilvray, Plasterer.

Members of Council.

P. MacGregor Chalmers, I.A., F.S.A Scot. Architect.
Colin Menzies, I.A., Architect.
John Rogerson, A.R.I.B.A., I.A., Architect.
John B. Wilson, A.R.I.B.A., I.A., Architect.
Robert Miller, I.A., Architect.
J. B. Lochhead, A.R.I.B.A., Architect.
Alex. Davie, Measurer.
H. D. Horne, Decorator.
Isaac Low, Plumber.
Moses Barlas, Mason.
William Meikle, Jr., Glass Stainer.
J. B. Nicol, Plasterer.

Chemical Section.

(In abeyance.)

Biological Section.

(In abeyance.)

Sanitary and Social Economy Section.

A. K. Chalmers, M.D., D.P.H. (Camb.), *President.*

Jas. R. Motion,
N. MacWhannell, I.A., } *Vice-Presidents.*

Members of Council.

Professor Glaister.
Dr E. Duncan.
John Lindsay.
Isaac Low.
John Lauder.
Gilbert Thomson, M.A., C.E.
Robert MacLaurin.
John S. Samuel.
Dr R. M. Buchanan.
Wm. Buchanan, *Hon. Secy.*

Geographical and Ethnological Section.

William Ewing, *President.*
Robert Blyth, C.A., *Vice-President.*
Robert Fullerton, M.D., *Honorary Secretary and Treasurer.*

Members of Council.

Robert Gow.
Freeland Fergus, M.D.
James Colville, D.Sc.
Sam. Mavor, F.R.G.S.
George Miller.
Robert Wilson Thom.

Mathematical and Physical Section.

Prof. Andrew Gray, LL.D., F.R.S., *President.*
Henry Dyer, D.Sc., M.A.,
Prof. James Blyth, M.A., LL.D., } *Vice Presidents.*
R. F. Muirhead, M.A., B.Sc., *Hon. Secretary and Treasurer.*

Members of Council.

H. Stanley Allen, M.A., B.Sc.
A. J. G. Barclay, M.A.
H. S. Carslaw, M.A., D.Sc.
Prof. W. Jack, LL.D.
T. Lindsay Galloway, C.E., M.A.
A. V. Lothian, M.A., B.Sc.
Prof. M. Maclean, D.Sc. M.A.
H. A. Mavor, M.I.E.E.
J. W. Peck, M.A.
Prof. Watkinson, M.I.M.E.

Historical and Philological Section.

George Neilson, *President.*
James Colville, M.A., D.Sc.,
F. J. Amours, B.A., } *Vice-Presidents.*
John Clark, M.A., *Hon. Secretary and Treasurer.*

Members of Council.

John Adams, M.A., B.Sc.
F. T. Barrett.
J. T. T. Brown.
D. H. Crawford, M.A.
David Lamb.
Alexander M'Donald, M.A.
Edwin Temple, B.A.
William Wallace, M.A., LL.D.
James Knight, M.A., B.Sc.

Economic Science Section.

John Mann, Jun., M.A., C.A., *President.*
Professor William Smart, LL.D.,
Robert Lamond, LL.B., } *Vice-Presidents.*
John A. Todd, B.L., 190 West George Street, *Hon. Secretary.*
* Duncan Mackenzie, *Hon. Treasurer.*

Members of Council.

* R. W. Cooke Taylor.
* G. Handasyde Dick.
Alex. Macindoe.
Thomas Jones.
W. W. Blackie, B.Sc.
A. Peden Fyfe.
Bailie D. M. Stevenson.
James F. Martin.

---

* *Retire by rotation in November, 1902.*

COMMITTEES APPOINTED BY THE COUNCIL.

Committee on Finance.

Professor BARR.
Dr FERGUS.
JOHN MANN, Jun.
R. GOODWIN.
J. F. CAMPBELL.
JOHN MANN.

JOHN MANN, *Convener.*

Committee on The Library.

Professor BARR.
Professor SMART.
Professor GLAISTER.
Professor FERGUSON.
F. T. BARRETT.
Dr FERGUS.
H. F. STOCKDALE.
Dr KERR.
GEORGE NEILSON.
Professor MACLEAN.
Professor GRAY.
WM. EWING.
Dr FINLAYSON.
JAMES CHALMERS.
GILBERT THOMSON.
JOHN ROBERTSON.
A. M. LINDSAY.
JAMES KNIGHT.
WM. S. CURPHEY.

JOHN ROBERTSON, *Convener.*

Committee on Papers.

Professor BARR.
JAMES CHALMERS.
GILBERT THOMSON.
Professor GLAISTER.
WM EWING.
Professor MACLEAN.
JOHN MANN, Jun.
Dr CHALMERS.
Professor SMART.
R. GOODWIN.
H. A. MAVOR.
Professor GRAY.
JAMES KNIGHT.
JOHN ROBERTSON.
J. F. CAMPBELL.
Dr KERR.
Dr FERGUS.
THE SECRETARIES OF SECTIONS.
GEORGE NEILSON.

Dr FERGUS, *Convener.*

Science Lecture Trust and Graham Medal Fund Committee.

Professor BARR.
Professor M'KENDRICK.
Professor GRAY.
Professor M. MACLEAN.
Dr FERGUS.
Professor FERGUSON.
W. S. CURPHEY.
H. A. MAVOR.
J. F. CAMPBELL.
Professor GLAISTER.

Professor MACLEAN, *Convener.*

House Committee.

Consisting of Members of the Royal Philosophical Society and of the Institution of Engineers and Shipbuilders in Scotland.

Institution of Engineers and Shipbuilders in Scotland.

WILLIAM FOULIS.
THOMAS ARTHUR ARROL.
ARCHIBALD DENNY.
CHARLES C. LINDSAY.
ALEXANDER GRACIE.
E. H. PARKER, *Secretary.*

Royal Philosophical Society.

Professor A. BARR.
Dr FERGUS.
JOHN MANN.
JOHN ROBERTSON.
J. F. CAMPBELL.
JOHN MANN, *Treasurer.*

ADDITIONS TO THE LIBRARY.

By Donation.

From the Smithsonian Institution—
On the Cheapest Form of Light. By S. P. Langley and F. W. Very (Smithsonian Miscellaneous Collections, Vol. XLI., No. 1258). Washington, 1901.

From the Geological Survey of Scotland—
Maps, 1" scale. No. 27 Portaskaig, Islay, Argyllshire, and No. 46, Balquidder, Perthshire.

From the Author—
County Council of Stirling—Tenth Annual Report of the Medical Officer of Health, 1900. By John C. M'Vail.

From the Author—
County Council of Dumbarton—Tenth Annual Report of the Medical Officer of Health, 1900. By John C. M'Vail.

From Mr James Knight—
Quarterly Journal of the Geological Society for August, 1901.

From the Corporation of Glasgow—
Report on certain cases of Plague occurring in Glasgow in 1900. By the Medical Officer of Health.

From the Volta Bureau—
Progress of Deaf-Mute Instruction in the United States. By J. C. Gordon. Pamph. 1901.

Fifth Report of the Home for the Training in Speech of Deaf Children before they are of School Age. 1900.

From the Author—
Tenth Annual Report on the Health and Condition of the County and District of Argyll, 1900. By R. M'Neill.

From the Author—
Photographs of Stars, Star-Clusters and Nebulæ. Vol. II. By Isaac Roberts. 4to, 1899.

From the Author—
Application of Quaternions to the Analysis of Internal Stress : a dissertation submitted to the Faculty of Cornell University for the degree of Doctor of Philosophy. By Charles W. Comstock, 1898. Denver, 1901.

From Dr Freeland Fergus—
Fourth Annual Report of Gartloch Asylum and Hospital for Mental Disorders, May, 1901.

From the Local Committee British Association—

Handbooks, British Association, Glasgow Meeting, 1901. Fauna, Flora, and Geology of the Clyde Area. Edited by G. F. S. Elliot, M. Laurie, and J. B. Murdoch. Glasgow, 1901.

Archæology, Education, Medical, and Charitable Institutions of Glasgow. Edited by Magnus Maclean. Glasgow, 1901.

Local Industries of Glasgow and the West of Scotland. Edited by Angus M'Lean. Glasgow, 1901.

Excursions, British Association, Glasgow Meeting, 1901. 13 Pamphlets.

From the Smithsonian Institution—

Annals of the Astrophysical Observatory of the Smithsonian Institution. Vol. I. Washington, 1900.

From the Ohio State University—

Thirteenth Annual Report of the Board of Trustees of the Ohio State University, 1900. Columbus, 1900.

From the Publishers—

Brown's Nautical Almanac for 1902. Glasgow.

From the Author—

Chemical Industries of the West of Scotland. By G. G. Henderson. Pamph. Glasgow, 1901.

From the Astronomer Royal—

Greenwich Observatory Publications :—

Astronomical Observations made at the Greenwich Observatory in the year 1898.

Results of Astronomical Observations made at the Greenwich Observatory in the year 1898 (extracted from the Greenwich Observations, 1898).

Results of the Magnetical and Meteorological Observations, 1898.

Results of the Spectroscopic and Photographic Observations, 1898.

Second Ten-year Catalogue of 6892 Stars for the Epoch 1890-1900, from Observations with the Transit-Circle (forming Appendix II. to Greenwich Observations, 1898).

Annals of the Cape Observatory. Vol. V. 4to. Edinburgh, 1900.

Annals of the Royal Observatory of the Cape of Good Hope. Vol. VIII., Part 2. Researches in Stellar Parallax made with the Cape Heliometer. By Sir David Gill. 4to, Edinburgh, 1900.

Results of Meridian Observations made at the Royal Observatory, Cape of Good Hope, 1861-70.

Refraction Tables arranged for use at the Royal Observatory, Greenwich, by P. H. Cowell (forming Appendix I. to the Greenwich Observations, 1898). 4to, 1899.

From Dr Freeland Fergus—

Twentieth Annual Report, with Volume of Maps, of the New York State Board of Health for 1899. Albany, 1901.

From Kaiserliche Leopoldino — Carolinische Deutsche Akademie der Naturforschen—

Repertorium zu den Acta und Nova Acta de Akademie. By Aruim Graesel. 2 Vols. 1894-99. Halle.

Geschichte der Bibliothek und Naturaliensammlung der Akademie. By Oscar Grulisch. Halle, 1894.

Geschichte der Kaiserlichen Leopoldinisch—Carolinischen Deutschen Akademie der Naturforscher, während der jahre, 1852-1887. By Phil. Willi ule. Halle, 1899.

From Mr John Mann, Jr—

Actes du Congrès International des Habitations a Bon Marché, Bruxelles. 1897.

Compte Rendu et documents du Congrès International des Habitations a Bon Marché. Paris, 1900.

From the Institute of Accountants and Actuaries in Glasgow—

Official Directory of the Chartered Accountants in Scotland. 1901-2.

From Professor Ernst Haeckel—

The Riddle of the Universe at the Close of the Nineteenth Century. Translated by Joseph M'Cabe. 1889.

From Mr James Knight—

Quarterly Journal of the Geological Society of London. Vol. LVII., Part 4, and Vol. LVIII., Part 1.

From the Trustees of the Hunterian Coin Catalogue Fund—

Catalogue of Greek Coins in the Hunterian Collection, University of Glasgow. Vol. II., 4to, Glasgow, 1902.

From the Geological Survey of Canada—

Catalogue of Canadian Birds. Part 1. By John Macoun. Ottawa. 1900.

From Mr Robert Anderson—

Water Supply of the City of Glasgow, with notes on various developments of the City till the close of 1900. By Sir J. D. Marwick. 4to. Glasgow. 1901.

From the Author—

Chemical and Physical Notes. By J. Y. Buchanan. (Reprinted from the Antarctic Manual. 1901.) Pamphlet.

From the Author—

Campbeltown Colliery and Light Railway. By T. L. Galloway. Glasgow. 1902.

From the Corporation of Glasgow—

Census, 1901. Report on Glasgow; its Sanitary Districts and Municipal Wards. By Dr A. K. Chalmers. Folio. Glasgow. 1902.

From the Royal Society of London—

Reports to the Malarial Committee. 6th Series. Relation of Malarial Endemicity to "Species" of Anopheles. Some points in the Biology of the Species of Anopheles found in Bengal. Relation between Enlarged Spleen and Parasite Infection. 1892.

From Dr Freeland Fergus—

Transactions of the Medico-Chirurgical Society of Glasgow. Vol. III. 1889-1901. Edited by W. R. Jack, and Hugh M'Laren. Glasgow. 1901.

From the Ninth Jubilee Committee—

Record of the Ninth Jubilee of the University of Glasgow. 1451-1901. Glasgow. 1901.

From the School Board of Glasgow—

Annual Report on School Work. January, 1902. Twenty-ninth Report of Progress in providing New Public Schools. February, 1902.

From Dr Robert Park—

Heredity. (Reprinted from the Scottish Medical and Surgical Journal. November, 1901.) Pamphlet.

By Purchase.

Annals of the Andersonian Naturalists' Society. Vol. II. Glasgow. 1900.

Avebury, Lord. Scenery of England and the Causes to which it is due. 1902.

Ball, Sir R. S. The Earth's Beginning. 1901.

Ball, W. W. R. Short Account of the History of Mathematics. 3rd edition. 1901.

Bernacchi, Louis. South Polar Regions Expedition of 1898-1900. 1901.

Barnard, F. P., Companion to English History (Middle Ages). Oxford. 1902.

British Rainfall—Distribution of Rain over the British Isles, during the years 1891-95, and 1900.

Brown, P. Hume. History of Scotland. Vol. II. Camb. 1902.

Bulletin of the American Mathematical Society. Vols. I. to III. 1891-94. Second Series. Vols. I. to VII. 1894-1902 and continued. New York.

Chatelier, H. Le, and Boudouard, O. High-Temperature Measurements. Translated by G. K. Burgess. New York. 1901.

Dallmeyer, T. R. Telephotography. 4to. 1899.

Dictionary of National Biography. Supplements. Vols. I., II. 1901.

Dictionary of National Biography. Supplement Vol. III. 1901.

Dolbear, A. E. Matter, Ether, and Motion, the Factors and Relations of Physical Science. Edited by Alfred Lodge. 1899.

Education (Scotland):—
  Training Colleges of Scotland—Reports and Papers. 1900.
  Report of the Committee of Council on Education in Scotland. 1900-1.
  Reports on the Northern, Western, and Southern Divisions for 1900.

Fountain, Paul. Great Deserts and Forests of North America. 1901.

Froude, J. A. Lectures on the Council of Trent, 1892-3. 1901.

Geikie, Sir Archibald. Scenery of Scotland viewed in connection with its Physical Geology. 3rd Edition. 1901.

Gibson, George A. Elementary Treatise on the Calculus. 1901.

Graham, H. G. Scottish Men of Letters in the Eighteenth Century. 1902.

Gray, Andrew. Theory and Practice of Absolute Measurements in Electricity and Magnetism. Vol. I. and Vol. II., in two parts. 1888, 1893.

Gray, Andrew. Treatise on Physics. Vol. I. Dynamics and Properties of Matter. 1901.

Hall and Neal. Ancient Ruins of Rhodesia. 1902.

Hinde, S. L., and Hinde, H. The Last of the Masai. 1901.

Hopkinson, John. Original Papers. 2 Vols. Edited by B. Hopkinson. Cambridge. 1901.

Hovenden, Frederick. What is Heat? and What is Electricity? 1900.

Hovenden, Frederick. What is Life? 2nd Edition. 1899.

Index to the Economic Journal. Vols I-X. 1891-1900.

Kydd, Benjamin. Principles of Western Civilization. 1902.

Lafar, Franz. Technical Mycology. Translated by C. T. C. Salter. Vol. I. Schizomycetic Fermentation. 1898.

Lang, Andrew. The Mystery of Mary Stuart. 1901.

Library World. Vol. I. 1898 and continued.

Lodge, Oliver J. Signalling across Space without Wires. 3rd Edition. N. D.

Lugton, Thomas. Old Ludgings of Glasgow, pre-Reformation Manses, etc. Glasgow. 1901.

Lynch, H. F. B. Armenia, Travels and Studies. 2 Vols., with map. 4to 1901.

Maitland, F. W. English Law and the Renaissance (Rede Lecture for 1901).

Michael, Albert D. British Tyroglyphidæ (Ray Society). Vol. I. 1901.

Miscellany of the Scottish Burgh Records Society—
  I. Report by Thomas Tucker upon the Settlement of the Revenues of Excise and Customs in Scotland. 1656.
  II. Register containing the State and Condition of every Burgh within the Kingdom of Scotland, in the year 1692.
  III. Setts of the Royal Burghs of Scotland. 4to. Edinburgh. 1881.

Moore, E. C. S. Sanitary Engineering. 2nd Edition. 1901.

Moore, J. E. S. To the Mountains of the Moon, being an Account of the Modern Aspect of Central Africa, and of some Little Known Regions traversed by the Tanganyika Expedition in 1889-1900. 1901.

Morley, John. Oliver Cromwell. 1901.

Paget, Sir James. Memoirs and Letters of. Edited by Stephen Paget. New Edition. 1902.

Palæontographical Society's Publications—

Elles, Gertrude L., and Wood, Ethel M. R. British Graphtolites. Part I. Edited by Charles Lapworth. 1901.

Foord, E. H. Carboniferous Cephalopoda of Ireland. Part VI. 1901.

Hind, Wheelton. Carboniferous Lamellibranchiata. Vol. II., Part 1. 1901.

Traquair, R. H. Ganoid Fishes of British Carboniferous Formations. Part 4, No. 2. 1901.

Woods, H. Cretaceous Lamellibranchia. Part III. 1901.

Rosebery, Lord. Napoleon: the Last Phase. 1900.

Rowntree, B. S. Poverty, a Study of Town Life. 2nd Edition. 1902.

Royal Society of London—Philosophical Transactions. Vol. CXCVA, and Vol. CXCVIA. 4to. 1901.

Scottish Burgh Records Society—

Glasgow—Charters and other Documents relating to the City of Glasgow. Parts I., II. A.D. 1175-1649. Edited by Sir James D. Marwick. 4to. Glasgow. 1894, 1897.

" Extracts from the Records of the Burgh of Glasgow. A.D., 1573-1642. 4to. Glasgow, 1876, and from 1630-1662. 4to. Glasgow. 1881.

Edinburgh—Charters and other Documents relating to the City of Edinburgh. A.D., 1143-1540. 4to. Edinburgh. 1871.

" Extracts from the Records of the Burgh of Edinburgh. 1403-1528, 1528-1557, 1557-1571, and 1573-1599. 5 Vols. 4to. Edinburgh, 1871-82.

" Index to Records from 1403-1589, and glossary of peculiar words. 4to. Edinburgh. 1892.

Aberdeen—Extracts from the Council Register of the Burgh of Aberdeen. 1625-1747. 2 Vols. 4to. Edinburgh. 1871-72.

Peebles—Charters and Documents relating to the Burgh of Peebles. 1165-1710. 4to. Edinburgh. 1872.

Scotland—Ancient Laws and Customs of the Burghs of Scotland. Vol I. 1124-1424. 4to. Edinburgh. 1868.

Scottish History from Contemporary Writers:—
  Mary Queen of Scots, 1542-1587. Edited by R. S. Rait. 2nd Edition. 1900.
  The Days of James IV. 1488-1513. Edited by G. G. Smith. 1890.
  The Chevalier de St. George and the Jacobite Movements in his Favour, 1701-1720. Edited by C. S. Terry. 1901.
Slater, H. H. Manual of the Birds of Iceland. Edinburgh. 1901.
Stokes, Sir George G. Mathematical and Physical Papers. Vol. III. Cambridge, 1901.
Strutt, J. W. (Baron Rayleigh). Scientific Papers. Vol. III. 1887-92. Cambridge. 1902.
Statesman's Year-Book, 1901.
Statesman's Year-Book. 1902.
Taylorian Lectures, 1889-1899—Studies in European Literature. By S. Mallarmé and others. 1900.
Wright's English Dialect Dictionary. Parts XI., XII. Ha-Jinketing.
Wylde, A. B. Modern Abyssinia, with map. 1901.

THE ROYAL PHILOSOPHICAL SOCIETY EXCHANGES WITH THE FOLLOWING SOCIETIES, ETC.:—

AFRICA.

Cape Town—
  South African Philosophical Society.
  Cape of Good Hope Observatory. The Astronomer Royal.

AUSTRALIA.

Brisbane—
  Royal Geographical Society of Australasia (Queensland Branch).

Melbourne—
  Royal Observatory Library.
  Patent Office.
  Royal Society of Victoria, Victoria Street.

Sydney—
  Geological Survey, Department of Mines. The Honourable the Minister for Mines.
  Royal Geographical Society of Australasia (New South Wales Branch).
  Royal Society of New South Wales, 5 Elizabeth Street, North.
  Technological Museum.

BELGIUM.

Brussels—

Académie Royale des Sciences.
Observatoire Royale.
Société Malacologique de Belgique.

Liège—

Société Royale des Sciences.

BRAZIL.

Rio-Janeiro—

Museu Nacional do Rio de Janeiro.

CANADA.

Halifax—

Nova Scotia Institute of Science.

Hamilton (Ont.)—

Hamilton Association.

London (Ont.)—

Entomological Society of Ontario.

Montreal—

Canadian Society of Civil Engineers, 112 Mansfield Street.

Ottawa—

Geological Survey of Canada, Sussex Street.
Royal Society of Canada.

Toronto—

Canadian Institute, 58 Richmond Street, East.

Victoria (B.C.)—

Library of the Legislative Assembly.

Winnipeg—

Manitoba Historical and Scientific Society.

CHINA.

Hong Kong—

Hong Kong Observatory.

ENGLAND AND WALES.

Barnsley—

Midland Institute of Mining, Civil, and Mechanical Engineers, Elder Street.

ENGLAND AND WALES—*continued.*

Bath—

Bath Natural History and Antiquarian Field Club. Royal Literary Institution

Birmingham—

Philosophical Society, Medical Institute, Edmund Street.

Bristol—

Bristol Naturalists' Society. Dr C. K. Rudge, Ashgrove House, 145 White Ladies' Road, Clifton.

Cambridge—

Philosophical Society, New Museum.
University Library. The Curator.

Cardiff—

Cardiff Naturalists' Society, 44 Loudoun Square.
South Wales Institute of Engineers, Park Place.

Falmouth—

Royal Cornwall Polytechnic Society.

Greenwich—
Royal Observatory. The Astronomer Royal.

Leicester—

Leicester Literary and Philosophical Society.

Liverpool—

Geological Society, Royal Institution, Colquitt Street.
Historic Society of Lancashire and Cheshire, Royal Institution.
Literary and Philosophical Society. Tate Librarian, University College.
Liverpool Engineering Society, Royal Institution, Colquitt Street.

London—

Anthropological Institute, 3 Hanover Square.
British Association for the Advancement of Science, Burlington House.
British Museum. The Superintendent, Copyright Office.
British Refrigeration Review, 101 Leadenhall Street, E.C.
Chemical Society, Burlington House.
Feilden Publishing Co., Temple Chambers, Embankment.
India-rubber and Gutta-percha and Electrical Trades Journal, 19 Wilson Street, E.C.
Institution of Civil Engineers, 25 Great George Street, Westminster.
Institution of Junior Engineers, 47 Fentiman Road, Clapham Road.
Institution of Mechanical Engineers, Storey's Gate, St James' Park, Westminster.
Middlesex Hospital, Berners Street.
Patent Office Library, 25 Southampton Buildings, Chancery Lane.

ENGLAND AND WALES—*continued.*

London—*continued.*

Pharmaceutical Society, 17 Bloomsbury Square.
Royal Geographical Society, 1 Saville Row.
Royal Institute of British Architects, 9 Conduit Street, Hanover Square.
Royal Institution of Great Britain, Albemarle Street, Piccadilly, W.
Royal Meteorological Society, 22 Great George Street, Westminster.
Royal Photographic Society, 5a Pall Mall, East.
Royal Society, Burlington House.
Royal Statistical Society, 9 Adelphi Terrace, Strand.
Society of Arts, John Street, Adelphi.
Society of Biblical Archæology, 37 Great Russell Street, Bloomsbury.
Society of Chemical Industry, Palace Chambers, 9 Bridge Street, Westminster.
Society of Engineers, 17 Victoria Street, Westminster.
Society of Physical Research, 19 Buckingham Street.
Engineering. The Publisher, 35 Bedford Street, Strand.

Manchester—

Manchester Association of Engineers, Grand Hotel, Aytoun Street.
Geographical Society, 16 St Mary's Parsonage.
Literary and Philosophical Society of Manchester, 36 George Street.

Middlesborough—

Cleveland Institution of Engineers.

Newcastle-upon-Tyne—

North-East Coast Institution of Engineers and Shipbuilders, 4 St Nicholas Buildings.
North of England Institute of Mining and Mechanical Engineers, Neville Hall.

Oxford—

Bodleian Library.

Stratford (Essex)—

Essex Field Club. Passmore-Edwards Museum, Romford Road.

Truro—

Royal Institution of Cornwall.

Watford—

Hertfordshire Natural History Society and Field Club, Herga. D. Hill, Hon. Librarian.

Welshpool—

Powys Land Club. The Secretaries, Museum and Library, Salop Road.

FRANCE.

Bordeaux—
- Société des Sciences Physiques et Naturelles.

Marseilles—
- Faculté des Sciences de Marseille.

Paris—
- Ecole Polytechnique. The Director.
- Observatoire Météorologique Central de Montsouris.

GERMANY.

Berlin—
- Deutsche Chemische Gesellschaft.
- Deutsche Kolonial Verein.
- Königliche Preussische Akademie der Wissenchaften.

Bremen—
- Geographische Gesellschaft.

Giessen (Hesse)—
- Oberhessische Gesellschaft für Natur-und-Heilkunde.

Griefswald (Prussia)—
- Geographische Gesellschaft.

Halle (Prussia)—
- Verein für Erdkunde.
- Kaiserliche Leopoldino—Carolinische Deutsche Akademie der Naturforscher.

INDIA.

Calcutta—
- Geological Survey of India.

IRELAND.

Belfast—
- Belfast Naturalists' Field Club, Museum, College Square, North.
- Natural History and Philosophical Society, Museum, College Square, North.

Dublin—
- Royal Dublin Society, Leinster House.
- Royal Irish Academy, 19 Dawson Street.
- Trinity College Library.

ITALY.

Milan—
- Reale Instituto di Lombardo di Scienze, Lettere, ed Arti.

JAPAN.

Tokio—
- Imperial University of Tokio, Science College.
- Imperial University of Tokio.

MEXICO.

Mexico—

Observatorio Astronómico Nacional de Tacubaya.
Sociedad Cientifica "Antonio Alzate."

NEW ZEALAND.

Wellington—

Colonial Museum.

NETHERLANDS.

Amsterdam—

Académie Royale des Sciences à Amsterdam.

Harlem—

Société des Sciences à Harlem.

Leyden—

Kon. Nederlandisch Aardrijkskundig Genootschap.

NORWAY.

Christiania—

Kongelige Norske Frederiks Universitet.

ROUMANIA.

Bucharest—

Societatiĭ de Sciinte Fizice.

RUSSIA.

Kazan—

Imperial Kazan University.

St Petersburg—

Académie Impériale des Sciences.
Russian Chemical Society of the University of St Petersburg.

SCOTLAND.

Aberdeen—

Philosophical Society, 147 Union Street.

Edinburgh—

Advocates' Library.
Botanical Society of Edinburgh, Royal Botanic Garden.
Geological Society, 5 St Andrew Square.
Highland and Agricultural Society of Scotland, 3 George IV. Bridge.
Royal Physical Society, 18 George Street.
Royal Scottish Geographical Society, Queen Street.
Scottish Meteorological Society, 122 George Street.
Royal Scottish Society of Arts, 117 George Street.
Royal Society, The Mound, Princes Street.

SCOTLAND—*continued.*

Glasgow—

Archæological Society, 88 West Regent Street.
Baillie's Institution Free Library, Miller Street.
Faculty of Physicians and Surgeons of Glasgow, 242 St Vincent Street.
Geological Society, 207 Bath Street.
Glasgow and West of Scotland Technical College Library, 38 Bath Street.
Institution of Engineers and Shipbuilders in Scotland, 207 Bath Street.
Mitchell Library, Miller Street.
Natural History Society of Glasgow, 207 Bath Street.
Stirling's Public Library, Miller Street.

Hamilton—

Mining Institute of Scotland.
Public Library.

Kelso—

Berwickshire Naturalists' Club. Rev. George Gunn, Stichill Manse.

SWEDEN.

Upsala—

Royal University Library.

Stockholm—

Kongliga Svenska Vetenskaps-Akademie.

UNITED STATES.

Austin (Texas)—

Texas Academy of Science.

Baltimore—

Johns Hopkins University.

Boston—

American Academy of Arts and Sciences.
Boston Society of Natural History.

Colorado Springs—

Colorado Scientific Society.

Davenport (Iowa)—

Academy of Natural Sciences.

Des Moines (Iowa)—

Iowa Geological Survey.

Indianopolis (Ind.)—

Indiana Academy of Science.

Lawrence (Kansas)—

Kansas University Quarterly.

UNITED STATES—*continued.*

Madison—

Madison Geological and Natural History Society.
Washburn Observatory.

Newhaven (Conn.)—

Connecticut Academy of Arts and Sciences.

New York—

American Geographical Society, 11 West Twenty-ninth Street.
American Museum of Natural History, Central Park, Seventy-seventh Street.
American Society of Civil Engineers, 220 West Fifty-seventh Street.
New York Academy of Sciences, Columbia University, West 116th Street.
School of Mines, Columbia College. The Associate Editor.

Philadelphia—

Academy of Natural Science of Philadelphia.
The Associated Alumni of the Central High School of Philadelphia.
American Pharmaceutical Association.
American Philosophical Society. The Hon. Secretaries, 104 South Fifth Street.
Franklin Institute, 15 South Seventh Street.
Numismatic and Antiquarian Society of Philadelphia.
Wagner Free Institute of Science, corner of Seventeenth Street and Montgomery Avenue.

Rochester (N.Y.)—

Rochester Academy of Science. Corresponding Secretary.

St. Louis—

Academy of Science of St Louis.
Missouri Botanical Garden.

San Francisco (California)—

California Academy of Sciences.

Topeka (Kansas)—

Kansas Academy of Science.

Washington—

Bureau of Education (Department of the Interior).
Bureau of Ethnology.
Smithsonian Institution.
United States Geological Survey.
United States National Museum (Department of the Interior).
United States Naval Observatory.

LIST OF PERIODICALS.

(Those received in exchange are indicated by an "a").

WEEKLY.

Academy.
Architect.
Athenæum.
British Journal of Photography.
*a*British Refrigeration Review.
Builder.
Building News.
Chemical News.
Comptes Rendus.
*a*Deutsche Kolonialzeitung.
Dingler's Polytechnisches Journal.
Electrical Review.
Electrician.
*a*Engineering.
English Mechanic.
*a*Illustrated Official Journal of Patents.
*a*India-Rubber and Gutta-percha and Electrical Trades Journal.
Journal of the Society of Arts.
*a*Journal of Gas Lighting.
*a*Lancet.
La Nature.
Nature.
Notes and Queries.
*a*Pharmaceutical Journal.
Scientific American and Supplement.

FORTNIGHTLY.

Annalen der Chemie (Liebig's).
*a*Berichte der Deutschen Chemischen Gesellschaft.
Journal für Praktische Chemie (Erdqmann's).
Zeitschrift für Angewandte Chemie.

MONTHLY.

*a*American Chemical Journal.
American Journal of Science.
Analyst.
Annalen der Physik und Chemie.
Annales de Chemie et de Physique.
Annales de l'Institut Pasteur.
Annales des Ponts es Chaussées.
Annales des Sciences Naturelles—Botanique.
Annales des Sciences Naturelles—Zoologie.
Annals and Magazines of Natural History.
Annales des Mines.
Antiquary.
Beiblätter zu den Annalen der Physik und Chemie.
Bulletin de la Société Chimique de Paris.
Bulletin de la Société Géologique de France.
Bulletin de la Société Industrielle de Mulhouse.
*a*Bulletin Mensuel de l'Observatoire de Montsouris.
*a*Canadian Entomologist.

MONTHLY—*continued.*

*a*Feilden's Magazine.
*a*Geographical Journal.
Geological Magazine.
*a*Johns Hopkins University Circulars.
Journal de Pharmacie et de Chimie.
Journal of Botany.
*a*Journal of the Chemical Society.
Journal of Education.
*a*Journal of the Franklin Institute.
*a*Journal of the Photographic Society.
*a*Journal of the Society of Chemical Industry.
*a*Journal de la Société Physico-Chimique Russe.
*a*Journal of the Western Society of Engineers.
London, Edinburgh, and Dublin Philosophical Magazine.
*a*Monatsbericht der Königlich Preussischen Akademie der Wissenschaften zu Berlin.
Petermanns Mitteilungen.
Polytechnic Bibliothek.
*a*Proceedings of the Royal Society of London.
Proceedings of the Society of Biblical Archæology.
Revue Universelle des Mines.
*a*Royal Astronomical Society's Monthly Notices.
Sanitary Journal.
Science Abstracts.
*a*Science of Man.
Science Gossip.
*a*Scottish Geographical Magazine.
*a*Travel.
Zoologist.

QUARTERLY.

Annals of Botany.
Annals of Scottish National History.
*a*Archives Néerlandaises des Sciences Exactes et Naturelles.
*a*Bulletin of the American Geographical Society.
Economic Journal.
Jahrbuch über die Forschritte der Mathematik.
Journal of Anatomy and Physiology.
*a*Journal of the Anthropological Institute of Great Britain.
*a*Journal of Manchester Geographical Society.
Journal of the Royal Agricultural Society of England.
*a*Journal of the Royal Institute of British Architects.
Journal of the Royal Microscopical Society.
*a*Journal of the Royal Statistical Society.
*a*Journal of the Scottish Meteorological Society.
*a*Kansas University Quarterly.
Mind: a Quarterly Review of Psychology and Philosophy.
*a*Proceedings of the American Philosophical Society.
Quarterly Journal of Economics.
*a*Quarterly Journal of Geological Society.
Quarterly Journal of Microscopical Science.
*a*Quarterly Journal of Royal Meteorological Society.
Quarterly Journal of Pure and Applied Mathematics.
Reliquary and Illustrated Archæologist.
Record of Technical and Secondary Education.
*a*School of Mines Quarterly.
*a*Sociedad Cientifica "Antonio Alzate."
*a*Transactions of the American Mathematical Society.
Zeitschrift für Analytische Chemie.

ANNUALLY.

Association Française pour l'Avancement des Sciences.
Cantor's Vorlesungen über Geschichte der Mathematik.
Hazell's Annual.
Jahres-Bericht Chemischen Technologie.
L'Année Scientifique et Industrielle.
Murray's English Dictionary.
Œuvres Complètes de Laplace.
Œuvres Complètes de Cauchy.
*a*Journal de L'Ecole Polytechnique.
Palæontographical Society's Publications.
Philosophical Transactions, Roya Society of London.
Ray Society's Publications.
Repertorium der Technischen Journal—Litterature.
Statesman's Year Book.
Symons' British Rainfall.
Wright's English Dialect Dictionary.

The LIBRARY and READING-ROOM are open:—Winter, 9.30 a.m. till 8 p.m.; Meeting Nights till 10 p.m.; Saturdays, 2 p.m.

Summer (May till October, except during the holidays in July), 9.30 a.m. till 5 p.m.; Saturdays, 1 p.m.

LIST OF MEMBERS
OF THE
Royal Philosophical Society of Glasgow
FOR 1901-1902.

HONORARY MEMBERS.
(Limited to Twenty.)
WITH YEAR OF ELECTION.

FOREIGN.

	Rudolph Albert von Kölliker, Würtzburg.	1860
	Professor Ernst Heinrich Hæckel, Jena.	1880
	Professor Georg Quincke, Hauptstrasse 47, Friederischbaw, Heidelberg.	1890

AMERICAN AND COLONIAL.

	Robert Lewis John Ellery, F.R.A.S., Victoria, Australia.	1874
5	Thomas Muir, M.A., LL.D., F.R.S.S., L. and E., Superintendent General of Education, Cape Colony.	1892
	Professor S. P. Langley, LL.D., D.C.L., Secretary of the Smithsonian Institution, Washington, U.S.A.	1895

BRITISH.

	Sir Joseph Dalton Hooker, C.B., G.C.S.I., M.D., D.C.L., LL.D., F.R.S., The Camp, Sunningdale.	1874
	Herbert Spencer, care of Messrs. Williams & Norgate, 14 Henrietta Street, Covent garden, London.	1879
	Rev. John Kerr, LL.D., F.R.S., Glasgow.	1885
10	Sir George Gabriel Stokes, Bart., M.A., LL.D., D.C.L., F.R.S., Lucasian Prof. of Mathematics in the Univ. of Camb., Lensfield cottage, Cambridge.	1887
	The Right Hon. Lord Rayleigh, M.A., D.C.L., LL.D., F.R.S., F.R.A.S., F.R.S.G., Prof. of Nat. Philosophy in the Royal Institution, London, Terling place, Witham, Essex.	1890
	The Right Hon. Lord Lister, LL.D., D.C.L., *P*.R.S., 12 Park crescent, Portland place, London, W.	1895
	Sir Archibald Geikie, LL.D., D.Sc., F.R.S., F.R.S.E., F.G.S., Director-General of the Geological Survey of the United Kingdom, 10 Chester terrace, Regent's Park, London, N.W.	1895
	The Right Hon. Lord Kelvin, G.C.V.O., LL.D., D.C.L., F.R.S., Largs. (*Ordinary Member*, 1846 *till* 1896.)	1896
15	James B. Russell, LL.D., M.D., 49 Braid road, Morningside, Edinburgh, *Honorary Vice-President*,	1899
	Sir William T. Gairdner, K.C.B., M.D., LL.D., F.R.S., Edinburgh. (*Ordinary Member*, 1863 *till* 1900.)	1900

CORRESPONDING MEMBERS.

WITH YEAR OF ELECTION.

A. S. Herschel, M.A., D.C.L., F.R.S., F.R.A.S., Hon. Professor of Experimental Physics in the University of Durham; Observatory House, Slough, Bucks. - 1874
Thomas E. Thorpe, Ph.D., F.R.S., F.R.S.E., Principal of the Government Laboratories, Clement's Inn-passage, W.C. - - - - - - - - 1874
John Aitken, LL.D., F.R.S., F.R.S.E., Ardenlea, Falkirk. - - - - - 1883
Alex. Buchan, M.A., LL.D., F.R.S.E., F.R.S., Secretary to the Scottish Meterological Society, 122 George street, Edinburgh. - - - - - - 1883
5 James Dewar, M.A., F.R.S., F.R.S.E., M.R.I., Jacksonian Professor of Physics, University of Cambridge, and Professor of Chemistry in the Royal Institution of Great Britain, 1 Scroope terrace, Cambridge. - - - - - - - 1883
Joseph W. Swan, M.A., F.R.S., 58 Holland Park, W. - - - - - - 1883
William Milne, M.A., B.Sc., F.R.S.E., Department of Public Education, Cradock, Cape Colony. - - - - - - - - - - - - 1894
Richard Lodge, M.A., Professor of History in Edinburgh University. - - - 1899
Edmund J. Mills, D.Sc., LL.D., F.R.S., Emeritus Professor of Technical Chemistry, Glasgow and West of Scotland Technical College, 11 Greenhill road, Harrow. - - - - - - - - - - - - - - 1901
10 Arthur Schuster, Ph.D., F.R.S., Professor of Physics, Victoria University, Manchester, Victoria park, Manchester. - - - - - - - - - 1901
W. S. M'Cormick, M.A., LL.D., 2 St Andrew's square, Edinburgh. - - - 1902

ORDINARY MEMBERS.

WITH YEAR OF ENTRY.

a Denotes Life Members.

Adam, Stephen, 199 Bath street. 1896
*a*Adam, Thomas, F.S.I., 27 Union street. 1892
Adams, John, M.A., B.Sc., Rector F.C. Training College, Glasgow, 12 Holyrood crescent. 1899
Adams, William, Makerstoun, Bearsden. 1891
5 Addison, W. H., Superintendent Mount Florida Deaf and Dumb Institution.
*a*Agar, Thomas F., Argentine Consul-General, 30 George square. 1896
Agnew, John, Viewfield, Carluke. 1901
Aikman, C. M., M.A., D.Sc., F.R.S.E., F.I.C., F.C.S., 128 Wellington street. 1886
Aikman, W. G., 12 Kingsborough gardens, Kelvinside. 1899
10 Alexander, D. M., Marionville, Queen's drive. 1887
Alexander, G. W., M.A., 129 Bath street. 1893
Alexander, John, M.D., 3 Queen's crescent, W. 1900
Allen, Herbert Stanley, M.A., B.Sc., Blythswood laboratory, Renfrew. 1901
*a*Allan, Henry, 2 Park gardens. 1900
15 Allan, James W., M.B., 18 India street. 1900
Alston, J. Carfrae, 27 James Watt street. 1887
Anderson, Alexander, 157 Trongate. 1869
Anderson, James, 4 Kingsborough gardens. 1900
Anderson, James, 168 George street. 1890
20 Anderson, James Scott, Auchnasith, Bearsden. 1902
Anderson, James Spencer, 81 Great Clyde street. 1901
Anderson, John, 142 West Nile street. 1884
Anderson, J. B. Mackenzie, M.B., 42 Lansdowne crescent. 1895
Anderson, R. T. R., 80 Seedhill rd, Paisley. 1889
25 Anderson, Robert, 76 Bath street. 1896
Anderson, Robert, Eastwoodhill, Giffnock. 1900
*a*Anderson, Robert Locke, 233 St Vincent street. 1901
*a*Anderson, T. M'Call, M.D., Professor of Practice of Medicine in the University of Glasgow, 2 Woodside terrace. 1873

Anderson, Wm, 12 Princes square. 1900
30*a*Anderson, William, 284 Buchanan street. 1890
Anderson, W. F. G., 47 Union street. 1878
Andrew, Grant, 12 Woodside terrace. 1900
*a*Andrew, James, 160 West George street. 1900
Angus, Robert, Lugar, Ayrshire, N.B. 1901
35*a*Annan, J. Craig, 234 Sauchiehall street. 1888
Annandale, Charles, M.A., LL.D., 35 Queen Mary avenue. 1888
Arneil, Allan, 13 Afton crescent. 1901
Arnot, James Craig, 162 St Vincent street. 1869
*a*Arnot, J. L., 204 Bath street. 1890
40 Arrol, William A., Torwoodhill, Row. 1869
*a*Arrol, Sir William, LL.D., Seafield, Ayr. 1900
Arthur, J., 78 Queen street. 1900
Arthur, Matthew, 78 Queen street. 1900
Arthur, Thomas G., Carrick house, Ayr. 1900

45 Bain, Andrew, 17 Athole gardens. 1890
Bain, Robert, 132 West Nile street. 1869
*a*Baird, J. G. A., M.P., Wellwood, Muirkirk. 1892
*a*Balfour, Alexander, Kelvindare, Kelvinside. 1900
Ballantine, George, jun., 100 Union street. 1897
50 Balloch, Robert, Eamont lodge, Dowanhill. 1843
Balmain, Thos, 1 Kew terrace, Kelvinside. 1881
Barbour, Wm, M.B., C.M., 5 Ashgrove terrace, Partickhill. 1900
Barclay, A. J. Gunion, M.A., F.R.S.E., High School. 1893
Barclay, A. P., 133 St Vincent street. 1890
55 Barclay, George, 8 Windsor circus. 1891
Barclay, James, 16 Roxburgh street, Kelvinside. 1871
Barnet, John, 55 Oswald street. 1901
*a*Barr, Archibald, D.Sc., Professor of Civil Engineering and Mechanics in the University of Glasgow, Royston, Dowanhill, *President*. 1890
*a*Barr, James, C.E., I M., F.S.I., 221 West George street. 1883
60 Barr, Thos, M.D., F.F.P.S.G., 13 Woodside place, W. 1879
Barrett, Francis Thornton, Mitchell Library. 1880
Bauermeister, F., 49 Gordon street. 1901
Baxter, John, I.M., 243 St Vincent street. 1901
Baxter, W. R., 64 Great George street, Hillhead. 1900
65 Bayne, A. Malloch, 13 Kelvin drive, Kelvinside. 1878
Beardmore, W., Parkhead Forge. 1901
Beatson, George T., B.A. (Cantab.), M.D., 7 Woodside crescent. 1881
Becker, L., Ph.D., Professor of Astronomy in the University of Glasgow, The Observatory. 1895
Beckett, William, M.A., 225 West George street. 1900
70 Begg, Wm, 636 Springfield road. 1883
Beilby, George T., F.I.C., St Kitts, Slateford. 1895
*a*Beith, Gilbert, 15 Belhaven terrace. 1881
Belhaven and Stenton, The Right Hon. Lord, Wishaw House, Wishaw. 1901
Bell, George, architect, 212 St Vincent street. 1900
75*a*Bell, Henry, Mynthurst, Reigate, Surrey. 1876
Bell, Sir James, Bart, 135 Buchanan street. 1877
*a*Bell, James T., Northcote, Dowanhill. 1896
*a*Bell, John J., Northcote, Dowanhill. 1896
*a*Bennett, Professor Peter, *Acting Secretary*, 207 Bath street. 1900
80 Bennett, Robert J., Alloway park, Ayr. 1883
Bergius, Walter, C.E., 77 Queen street. 1897
*a*Biggart, Thomas, 105 West George street. 1900
Bilsland, William, 28 Park circus. 1888
*a*Birkmyre, John, Broadstone, Port-Glasgow. 1900
85*a*Bishop, A. Henderson, Burncroft, Thorntonhall. 1896
Black, J. Albert, Duneira, Row. 1869
Black, Malcolm, M.D., 5 Canning place. 1880
*a*Black, William Dunn, J.P., Auchentoshan, Dalmuir. 1901
*a*Blackie, J. Alexander, 17 Stanhope street. 1881
90*a*Blackie, J. Robertson, North Bank, Dowanhill. 1881
Blackie, W. G., Ph.D., LL.D., F.R.G.S., 1 Belhaven terrace, Kelvinside. 1841
*a*Blackie, Walter W., B.Sc., 17 Stanhope street. 1886
Blackwood, Matthew, Ardmore, Port-Glasgow. 1901
Blair, J. M'Lellan, Williamcraig, Linlithgowshire. 1869
95 Blair, Matthew, 29 Montrose street. 1887

Blyth, Jas, M.A., LL.D., F.R.S.E., Professor of Natural Philosophy, Glasgow and West of Scotland Technical College, 204 George street. 1881

*a*Blyth, Robert, 1 Montgomerie quadrant. 1885

*a*Blythswood, The Rt Hon. Lord, Renfrew, *Hon. Vice-President.* 1885

*a*Borland, William, 142 West George street. 1895

100 Borthwick, James D., 46 Balshagray avenue, Partick. 1891

Bottomley, James T., M.A., D.Sc., F.R.S., F.R.S.E., F.C.S., 13 University gardens, Hillhead. 1880

Bottomley, Wm, C.E., 15 University gardens. 1880

Bower, F.O., D.Sc., M.A., F.R.S., F.L.S., Regius Professor of Botany in the University of Glasgow, 1 St John's terrace, Hillhead. 1885

*a*Boyne, James, 106 West Nile street. 1901

105 Boyd, John, Shettleston Iron-works, near Glasgow. 1873

*a*Broadfoot, William R., Inchholme Works, Whiteinch. 1900

Brodie, Wm Brodie, M.B., C.M., Muirhead Demonstrator of Physiology, University of Glasgow. 1897

Bromhead, Horatio K., A.R.I.B.A., I.A., 243 St Vincent st. 1901

Brown, Alex., The Craigs, Carmunnock. 1896

110 Brown, A. M., 22 West Nile street. 1900

Brown, George Arbuckle, M.B., C.M., D.P.H.(Camb.), 2 Oswald place, Whiteinch. 1900

*a*Brown, Hugh, 5 St John's terrace, Hillhead. 1887

Brown, James, 76 St Vincent street. 1876

*a*Brown, John, 11 Somerset place. 1881

115 Brown, John Armour, Moredun, Paisley. 1901

*a*Brown, Nicol Paton, 22 Belhaven terrace. 1901

Brown, Richard, Professor of Mercantile Law, St Mungo's College, 166 St Vincent street. 1895

Brown, Robert, 19 Jamaica street. 1882

Brown, Thomas Mathieson, coalmaster, Ardnith House, New Cumnock, Ayrshire. 1901

120 Brown, Wm, F.S.A.A., F.S.I., 138 West Regent street. 1901

*a*Brown, Wm Stevenson, 67 Washington street. 1886

*a*Brown, William, 165 West George street. 1892

Browne, Robert, B.Sc., 45 Washington street. 1893

Brownlee, Jno., Glasgow Fever Hospital, Belvidere. 1902

125 Brownlie, John Douglas, M B., Ch.B., L.D.S., 10 Brandon place. 1901

Brownlie, J. Rankin, L.D.S. (Eng.), 220 West George street. 1892

Bruce, Alex., Clyne House, Pollokshields. 1901

Bruce, David, M.A., LL.B., 141 West George street. 1897

Bryce, John, Assoc. M.Inst.C.E., Maxwell street, Partick. 1900

130 Bryden, Robert A., F.R.I.B.A., F.S.I., 212 St Vincent street. 1872

Buchan, David W., Fairy Knowe, Cambuslang. 1896

Buchanan, George Douglas, Fairholm, Giffnock. 1901

Buchanan, George S., 85 Candleriggs. 1845

Buchanan, Peter, 7 Garthland street. 1901

135 Buchanan, Rev. Robert, B.D., 28 Queen's crescent, Edinburgh. 1901

Buchanan, Robert Macneil, M.B., C.M., F.F.P.S.G., 9 Burnbank terrace. 1900

Buchanan, Walter, Clerkhill House, Dumbarton. 1901

*a*Buchanan, Wm, Enderley, Bearsden. 1886

Burnet, John James, A.R.S.A., F.R.I.B.A., 18 University avenue. 1892

140 Burns, J., M.D., 15 Fitzroy place, Sauchiehall street. 1864

Burton, Thomas John, M.D. (Ed.), Lonsdale, Bearsden. 1896

Burton, William L., 6 Richmond crescent, Glasgow. 1899

*a*Burrell, Wm, 54 George square. 1900

Caird, Robert, LL.D., F.R.S.E., 56 Esplanade, Greenock. 1898

145 Calder, William Ramsay, 102 Hope street. 1901

*a*Caldwell, George B., Scotia Leather Works, Boden street. 1892

Caldwell, James, 6 Newton place. 1900

Cameron, Sir Charles, Bart, M.D., LL.D., Greenock. 1870

Cameron, Sir Hector C., M.D., Professor of Clinical Surgery, University of Glasgow, 200 Bath street. 1873

150 *a*Campbell Arch., Springfield quay. 1895

*a*Campbell, J. A., LL.D., M.P., Stracathro, Brechin. 1848

Campbell, James Murdoch, 147 George street. 1901

Campbell, John, 49 St Andrew's drive, Pollokshields. 1901
*a*Campbell, John Ferguson, 2 Holborn terrace, N. Kelvinside, *Vice-President.* 1892
155 Campbell, John M., F.E.I.S., Kennedy St Public School, and 14 Royal crescent, Crosshill. 1900
Campbell, John MacNaught, C.E., F.Z.S., F.R.S.G.S, 5 Franklin terrace, Dumbarton road. 1883
Campbell, Malcolm, 18 Gordon street. 1894
*a*Campbell, Thomas, Maryhill Iron works. 1894
Cant, James, Woodholm, Bridge-of-Weir. 1901
160 Cargill, David S., 9 Park terrace. 1900
Carlile, William W., Hailie, Largs, Ayrshire. 1897
Carmichael, Neil, M.D., C.M., F.F.P.S.G., Invercarmel, 23 Nithsdale drive, Pollokshields. 1873
Carslaw, Horatio S., M.A., Assistant to the Professor of Mathematics, University of Glasgow. 1898
Carver, Thomas, A. B., B.Sc., C.E., 118 Napiershall street. 1890
165 Cayzer, Herbert Robin, Ralston, Renfrewshire. 1901
*a*Cayzer, Sir Charles W., M.P., 109 Hope street. 1886
Chalmers, A. K., M.D., D.P.H. (Camb.), 7 Buckingham terrace. 1892
Chalmers, George, 13 Hamilton crescent, Partickhill. 1896
Chalmers, James, I.A., 93 Hope street. 1884
170 Chalmers, P. MacGregor, I.A., F.S.A.Scot., 95 Bath street. 1891
Chamen, W. A., Drumard, Partickhill road. 1898
Chisholm, James, 16 Knowe terrace, Pollokshields. 1899
Chisholm, John Oliver, surgeon, 16 Windsor terrace, St George's road. 1900
*a*Chisholm, Samuel, LL.D., Lord Provost of Glasgow, 20 Belhaven terrace. 1890
175*a*Christie, Henry W., Levenfield House, Alexandria. 1892
Christie, John, Turkey-red Works, Alexandria, Dumbartonshire. 1868
*a*Christison, George, 13 Cambridge drive. 1897
Chrystal, W. J., F.I.C., F.C.S., Shawfield Works, Rutherglen. 1882
Clanachan, John, 4 Lloyd street, Dennistoun. 1900
180 Clark, John, Ph.D., F.I.C., F.C.S., 138 Bath street. 1870
Clark, John, 9 Wilton crescent. 1872
Clark, John, M.A., 2 Kersland st, Hillhead. 1897
*a*Clark, William, 125 Buchanan st. 1876
*a*Clarke, James Ferguson Wylie, M.A., F.R.C.S.Ed., 24 Buckingham terrace, Edinburgh. 1900
185 Cleland, James William, 1 Elm Court, Temple, London, E.C. 1901
*a*Cleland, John, M.D., LL.D., D.Sc., F.R.S., Professor of Anatomy in the University of Glasgow. 1884
*a*Coats, Archibald, Woodside, Paisley. 1900
Coats, John J., M.A., 27 Woodside place. 1900
*a*Cochran, Robert, 7 Crown circus, Dowanhill. 1877
190 Coghill, Wm C., 24 Douglas street. 1873
Colquhoun, Walter, M.A., M.B., C.M., 7 Stanley street, W. 1900
Colville, James, M.A., D.Sc., 14 Newton place. 1885
Colvin, Thomas, M.D., 6 Royal terrace, Crosshill. 1900
*a*Combe, James Russell, 2 Royal crescent, Crosshill. 1895
195*a*Connell, Charles Broadfoot, Scotstoun Shipbuilding Yard, Whiteinch. 1900
*a*Connell, James G., 44 St Enoch's square. 1900
Connell, Wm., Fairhill, Hamilton. 1870
Connell, William, jun., Coldstream, Cathkin road, Langside. 1897
Connor, George Muir, M.B., C.M., 574 Gallowgate. 1900
200 Cook, William, 77 St Vincent street. 1900
Cooke-Taylor, R. W., West Lodge, Crown terrace. 1898
Copland, Wm R., M.Inst.C.E., F.S.I., 146 West Regent street. 1876
Core, Wm, M.D., Barnhill Hospital. 1891
Cormack, J. D., B.Sc., Prof. of Mechanical Engineering, University College, Gower street, London, W.C. 1898
205 Corrie, David, F.C.S., "Nobels," Polmont Station. 1902
Costigane, John T., Limekilns House, East Kilbride. 1889
Costigane, William, Clifton hall, Albert drive, Pollokshields. 1890
Coubrough, A. Sykes, Parklea, Blanefield, Strathblane. 1869
Coulson, W. Arthur, 47 King street, Mile-end. 1888
210 Couper, James, Craigforth House, Stirling. 1862
Couper, Sinclair, Moore Park Works, Helen street, Govan. 1896
Cowan, M'Taggart, C.E., 53 Ashton terrace, Hillhead. 1876

Cowie, Archd, 196 St Vincent street. 1900

Craig, T. A., C.A., 139 St Vincent street. 1886

215 *a*Crawford, R. C., 12 Derby crescent, Kelvinside. 1902

Cree, Thomas S., 21 Exchange square. 1869

Crichton, James, 201 Nithsdale road, Pollokshields. 1892

*a*Crookston, George B., 188 St Vincent street. 1900

Cross, Alexander, M.P., 14 Woodlands terrace. 1887

220 *a*Cruikshank, Robert Alexander, J.P., shipowner, Ardbeg, Kilmun. 1901

*a*Crum, Walter G., Thornliebank. 1895

Crum, William G., Thornliebank. 1896

*a*Cullen, Alexander, F. R. S. E., F.R.I.B.A., Millburn, Dalserf, by Netherburn. 1901

*a*Curphey, Wm Salvador, Borva, Lenzie. 1883

225 *a*Cuthbertson, Sir John N., LL.D., 29 Bath street. 1850

Cuthbertson, Thomas W., M.A., 25 Blythswood square. 1897

Dalrymple, James D. G., F.S.A., Meiklewood, Stirling. 1902

*a*Daly, James, 2 Prince's gardens. 1898

Dalziel, T. Kennedy, M.B., C.M., 196 Bath street. 1896

230 Dansken, A. B., 105 West George street. 1877

*a*Dansken.John, I.M., F.S.I., F.R.A.S., 241 West George street. 1876

Darling, William, 178 St Vincent street. 1901

Dempster, John, 7 Knowe terrace, Pollokshields. 1875

Dennison, William, C.E., 175 Hope street. 1876

235 *a*Dick, George Handasyde, 136 Buchanan street. 1887

Dick, Thomas, 166 St Vincent street. 1901

Dickie, John S., 31 St Vincent place. 1900

*a*Dixon, A. Dow, 10 Montgomerie crescent, Kelvinside. 1873

*a*Dixon, James S., Fairleigh, Bothwell. 1900

240 Dixon, Walter, 59 Bath street. 1893

Dobbie, A. B., M.A., 24 West Cumberland street. 1885

*a*Dobbie, Robert, Beechmount, Larbert. 1900

Docherty, P. Alpine, L.R.C.P., L.R.C.S.Edin., etc., 526 Springburn road. 1900

*a*Donald, James Addie, 12 Waterloo street. 1900

245 Donald, John, 23 Queen Margaret drive, N. Kelvinside. 1872

Donald, William, J. A., 16 Lilybank gardens. 1877

Dougall, Franc Gibb, 167 Canning street. 1875

Douglas, Campbell, I.A., F.R.I.B.A., 266 St Vincent street. 1870

Downie, Dr Walker, 4 Woodside crescent. 1901

250 Downie, Robert, jun., Carntyne Dyeworks, Parkhead. 1872

Downie, Thomas, Hydepark Foundry. 1886

*a*Dreghorn, David, Smith st, Kinning Park. 1896

*a*Duncan, Eben., M.D., C.M., F.F.P.S.G., Queen's Park house, Langside road, *Hon. Vice-President.* 1873

Duncan, Hugh, M.A., LL.B., 27 University avenue. 1895

255 Duncan, J. A., Glenlee, Bridge of Allan. 1896

*a*Duncan, Robert, Whitefield Works, Govan. 1890

Dunlop, David John, Inch Works, Port-Glasgow, and 198 Bath street. 1900

Dunlop, John, F.E.I.S., headmaster, Parkhead Public School. 1900

Dunlop, John, M.D., 1 Somerset place. 1900

260 Dunlop, Matthew, 7 Clairmont gardens. 1901

*a*Dunlop, Nathaniel, 25 Bothwell st. 1870

Dunn, James E., 27 Union street, Glasgow, and Dunmullin, Strathblane. 1900

Dunn, Hugh Shaw, Earlston Villa, Caprington, Kilmarnock. 1901

Dunn, Robert Hunter, 4 Belmont crescent. 1878

265 Duthie, Andrew Drummond, 2 Rothesay Gardens, Partickhill. 1902

Duthie, James, 129 St Vincent street. 1901

Dyer, Henry, M.A., D.Sc., C.E., 8 Highburgh terrace, Dowanhill. 1883

*a*Edington, George Henry, M.D., M.R.C.S. (Eng.), F.F.P.S.G., 225 Bath street. 1896

Edmiston, John C., M.D., F.F.P.S.G., 6 Wilton gardens. 1901

270 *a*Edwards, John, 4 Great Western terrace, west. 1883

Elgar, Francis, LL.D., F.R.S., 34 Leadenhall street, London, E.C. 1884

Elliot, Professor G. F. Scott, M.A., B.Sc., F.L.S., F.R.G.S., Fore house, Kilbarchan, Renfrewshire. 1896

Elliott, Joseph J., City Chambers. 1901
Erskine, Jas, M.A., M.B., L.F.P.S.G., 351 Bath street. 1886
275 Ewan, Thomas, M.Sc., Ph.D., 30 Lansdowne crescent. 1901
*a*Ewing, Wm, 45 Renfield street. 1883

*a*Faill, John, 7 Winton drive, Kelvinside. 1901
Fairweather, Wallace, C.E., 62 St. Vincent street. 1880
Falconer, Patrick, 13 Sutherland street, Hillhead. 1876
280 Falconer, Thos, 50 Kelvingrove st. 1880
Farrelly, John, 25 Elmbank crescent. 1901
*a*Farquhar, Jas T., 47 Hope street. 1901
Farquhar, Wm R., St Malo, Kilmalcolm. 1892
Fawsitt, Charles A., 9 Foremount terrace, Partick. 1879
285*a*Fergus, Freeland, M.D., F.R.S.E., F.F.P.S.G., *Hon. Secy.*, 22 Blythswood sq. 1887
Fergus, James, 58 York street. 1901
*a*Fergus, Oswald, D.D.S., L.D.S., 12 Clairmont gardens. 1896
Ferguson, Alexr., 106 W. Regent street. 1901
Ferguson, David, Glenholm, Port-Glasgow. 1901
290 Ferguson, Fergus, 20 Royal terrace, West. 1900
Ferguson, James, 58 Millbrae road, Langside. 1897
*a*Ferguson, John, M.A., LL.D., F.R.S.E., Professor of Chemistry, University of Glasgow, *Hon. Vice-President*. 1869
Ferguson, John Forbes, 166 St Vincent street. 1895
Fife, William, jr, Fairlie, Ayrshire. 1901
295 Findlay, Joseph, Clairmont, Winton drive, Kelvinside. 1873
Finlayson, James, M.D., 2 Woodside place. 1873
Fleming, Dr Robert H., 19 Newton street, Charing cross. 1901
*a*Fleming, E. Brown, Mambeg, Dumbartonshire. 1900
*a*Fleming, James, 136 Glebe street. 1880
300 Fleming, James H., L.R.C.S.E., L.R.C.P.E., L.F.P.S.G., 338 Duke street, Dennistoun. 1900
*a*Fleming, John, 241 St Vincent st. 1900
Flower, Collingwood, Auchnacrioch, by Yoker, Renfrewshire. 1901
*a*Forrester, Henry, 45 West Nile street. 1900
Forrester, Robert, 142 West Nile st. 1901
305 Foster, W. A., St Catherines, Newlands road, Langside. 1899
Fotheringham, T. B., 52 Barrland street, Maxwell road. 1889
Foulis, William, C.E., 45 John st. 1870
*a*Fowler, John, 2 Grantley gardens, Shawlands. 1880
Frame, James, 45 Keir street, Pollokshields. 1885
310 Fraser, James, 53 Queen Mary avenue, Crosshill. 1901
Fraser, Melville, 31 St Vincent place. 1890
*a*Fraser, Thomas Smellie, F.S.I., 209 St Vincent street. 1900
*a*Fraser, Wm, F.S.I., 209 St Vincent street. 1900
Freebairn, J. B., M.A., Napiershall Public School. 1900
315*a*French, Thomas, 1 Kelvinside ter. 1897
Frew, Alex., C.E., Assoc. M. Inst. C.E., 140 West George street 1876
*a*Frew, William, Ph.D., Wellpark Brewery. 1898
Fryers, Arthur John, 22 Bath street, Largs. 1899
*a*Fullerton, Robt., M.D., 24 Newton place. 1896
320 Fulton, James, The Glen, Paisley. 1897
Fulton, R. C., 14 Hamilton Park terrace. 1890
Fyfe, Alexander, 38 Burnbank gardens. 1897
Fyfe, A. Peden, 135 St Vincent street. 1900
Fyfe, Henry B., 115 St Vincent street. 1892

325*a*Gairdner, C. D., C.A., 115 St Vincent street. 1886
Galbraith, Peter, 122 Wellington st. 1889
Galbraith, Walter M., 7 Holyrood crescent. 1893
Gale, James M., C.E., 45 John st. 1856
Galloway, T. Lindsay, C.E., 43 Mair street, Plantation. 1881
330 Galt, Professor Hugh, M.B., C.M., F.F.P.S.G., D.P.H.(Camb.), 14 Berkeley terrace, W. 1900
Gardiner, John, 18 Gibson street, Hillhead. 1901
Gardner, Daniel, 36 Jamaica street. 1869
Gardner, John, 146 Trongate. 1901
Gardner, John R., 33 Huntly gardens, Kelvinside. 1900
335*a*Garrett, Geo., Dunbeth lodge, Coatbridge. 1901
*a*Garrow, James R., 6 Pollok road. 1890
*a*Garroway, John, 694 Duke st. 1875
Gemmill, James Fairlie, M.A., M.D., Lecturer in Embryology, University of Glasgow. 1901

Gibson, Charles R., Lynton, Mansewood, by Pollokshields. 1895
340 Gibson, William, 2 Wilton mansions. 1896
Gilfillan, Robert, Springbank Public School, Hinshaw street. 1900
Gilfillan, Wm, 129 St Vincent st. 1881
*a*Gillies, William, 23 University gardens. 1901
Gillies, W. D., 17 Royal Exchange square. 1872
345 Glaister, John, M.D., F.F.P.S.G., D.P.H. (Camb.), F.R.S.E., F.C.S., &c., Professor of Forensic Medicine and Public Health, University of Glasgow, 18 Woodside place, *Vice-President.* 1879
*a*Glaister, Joseph Newbigging, M.B., C.M., 5 Ronald street. 1900
*a*Glen, Lawrence, 165 St Vincent street. 1900
*a*Glen, Robert, Carlston, Kelvinside. 1901
Goldie, James, 52 St Enoch square. 1883
350 Goodwin, Robert, 58 Renfield street. 1875
*a*Gordon, James, Stonebyres, 14 Aytoun road, Pollokshields. 1901
Gordon, John, M.D., C.M., 3 Rosebery terrace, Kelvinbridge. 1900
*a*Gourlay, Charles, B.Sc., A.R.I.B.A., Professor of Architecture, Glasgow Technical College, 30 Hamilton drive, Hillhead. 1900
Gow, Leonard, 45 Renfield street. 1889
355 Gow, Leonard, jun., 45 Renfield street 1884
Gow, Robert, 3 Victoria circus, Dowanhill gardens. 1860
Graham, John Hatt Noble, Larbert House, Stirlingshire. 1900
*a*Graham, Robert, 108 Eglinton st. 1888
*a*Graham, William, B.L., 198 West George street. 1885
360*a*Graham, William, C.A., 6 Royal crescent, W. 1900
Graham, Wm Edward Auld, 7 Royal Bank place. 1900
Graves, John William, Hydropathic, Kilmalcolm. 1901
Gray, Alexander Elmworth, Port-Glasgow. 1901
Gray, Andrew, 30 Bath street. 1889
365 Gray, Andrew, LL.D., F.R.S., Professor of Natural Philosophy in Glasgow University. 1899
Gray, James, M.D., 15 Newton terrace. 1863
Gray, John, 181 Renfrew street. 1901
Green, George, J.P., 40 Balshagray avenue, Partick. 1900
Greer, Thomas Arthur, Fairfield works, Govan. 1901
370 Greig, James R., Claremont, Langside. 1897
Grier, R. P., 54 Newark drive, Pollokshields. 1901
Gumprecht, John, 8 Lyndoch street. 1900
Gunn, John, B.L., 37 Bath street. 1901
Gunn, N. B., 35 St Vincent place. 1900
375 Guthrie, David William, 9 Jane street, Blythswood square. 1900
Guthrie, James, R.S.A., 7 Woodside place. 1901
Guthrie, John, 17 Whittinghame drive, Kelvinside. 1901

Halket, George, M.D., F.F.P.S.G., 4 Royal crescent, W. 1889
Hall, Peter Wishart, Kyle street, Dobbie's loan. 1901
380*a*Hamilton, John, I.A., 212 St Vincent street. 1885
Hamilton, Robert O., Victoria Grain Mills, West street, Kingston. 1898
Hanbidge, James E., 8 Balmoral crescent, Crosshill. 1897
Hannay, P. M., Bridge of Allan. 1898
Harrington, John C., 14 Queen's Gate, Dowanhill. 1901
385*a*Harrington, J. P., Broadfield, Port-Glasgow. 1900
Harington-Stuart, R. E. S. (Colonel), Torrance, East Kilbride, N.B. 1900
Harris, F. W., 81 Gower street, Kelvinside, N. 1900
Harrison, John, J.P., 7 Granby terrace. 1900
*a*Hart, Robert, 8 Greenlaw Avenue, Paisley. 1902
390 Harvey, William Ure, Ornsay, Glenburn road, Bearsden. 1896
Harvie, William, 8 Bothwell terrace, Hillhead. 1888
Hassard, William John, 209 Sauchiehall street. 1895
Hedderwick, Maxwell, 22 St Vincent place. 1892
*a*Henderson, A. P., 20 Newton place. 1880
395 Henderson, Francis, 47 Union street. 1901
Henderson, George G., M.A., D.Sc., F.I.C., F.C.S., Professor of Chemistry, Glasgow and West of Scotland Technical College, 204 George street. 1883
*a*Henderson, Thomas, 1 Lancaster crescent, Kelvinside. 1900
Henderson, Thomas Beath, M.D., 155 Bath street, Glasgow. 1899
*a*Henderson, William, 15 Cadogan street 1873

400 Hendry, Geo. Scott, 87 Bothwell st. 1895
Henry, R. W., 9 Parkgrove ter., W. 1875
Heys, Zechariah J., South Arthurlie, Barrhead. 1870
Higgins, Henry, jun., 248 West George street. 1878
Hinshelwood, James, M.A., M.D., 26 Woodside place. 1896
405 Hodge, James R., C.A., 105 West George street. 1900
Hodge, William, 27 Montgomerie drive, Kelvinside. 1878
Hogg, Robert, 163 Nithsdale road, Pollokshields. 1865
Holmes, Daniel T., B.A., Woodburn, Kilmalcolm. 1898
Honeyman, P. S., 12 South Park terrace. 1900
410 Hood, Archibald J., M.A., 2 Kelvingrove terrace, 1901
*a*Hope, James, Dean house, Lenzie. 1898
Horne, Joseph, M.B., C.M., 5 Windsor street. 1900
*a*Houldsworth, J. H., Rozelle, Ayr. 1900
*a*Houldsworth, Wm Thos, Clerk in Holy Orders, 1 Mansfield street, Portland place, London, W. 1901
415 Houstoun, Wm Henry, Hillcrest, Cambridge drive. 1895
Howat, William, 37 Elliot street. 1885
Hunt, Edmund, 121 W. George st. 1856
*a*Hunt, John, Milton of Campsie. 1881
Hunter, James, 89 Mitchell street. 1900
420 Hunter, Richard H., Glentyan, Kilbarchan, Renfrewshire. 1900
Hunter, Robert, 72 Waterloo street. 1901
Hunter, the Rev. John, D.D., London. 1899
Hunter, Walter K., M.D., 1 Newton terrace, Glasgow. 1899
*a*Hunter, Wm S., 70 Robertson st. 1889
425 Hutchison, John C., 8 Lansdowne crescent. 1900
Hutchison, Joseph, Woodside, Netherburn, Lanarkshire. 1901
Hutton, James, C.A., 203 West George street. 1897
Hutton, W. K., M.A., M.B., Senior Demonstrator of Anatomy, The University. 1900
*a*Hyslop, William, of Bank, New Cumnock. 1901

430 Inglis, John, LL.D., Pointhouse Shipyard. 1895
*a*Inglis, Malcolm, 48 St Andrew's sq. 1900
Inglis, R. A., Culrain, Bothwell, 1889
Innes, Gilbert, 27 Hamilton drive, Hillhead. 1900
Inverclyde, Lord, The Right Hon., Castle Wemyss, Wemyss Bay. 1900

435 Jack, William Robert, M.D., 43 Lansdowne crescent. 1899
*a*Jack, William, M.A., LL.D., Professor of Mathematics in the University of Glasgow. 1881
Jackson, Robert, 16 Dixon avenue, Crosshill. 1902
Jackson, Thomas, C.A., 24 George square. 1900
Jamieson, Andrew, F.R.S.E., M.Inst.C.E., M.Inst.E.E., etc., 16 Rosslyn terrace, Kelvinside. 1881
440 Jenkins, James Graham, Airedale, Cambuslang. 1901
Jenkins, Thomas, Woodlands, Crosshill. 1901
Johnston, Alex., M.D. (Glasgow), D.P.H. (Camb)., Ruchill Hospital. 1900
Johnston, David, 160 West George street. 1891
Johnston, George, Mosesfield, Springburn. 1896
445 Johnston, William G., 18 Coatbridge street, Port Dundas. 1901
Johnstone, Jas, Coatbridge street, Port-Dundas. 1869

Kay, Cathcart, 77 St Vincent st. 1900
Kay, Thomas, M.B., C.M., 5 Rosebery street. 1899
Kean, James, 32 Scotia street, Garnethill. 1888
450 *a*Kelly, Alexander, 100 Hyde Park street. 1901
Kelly, Hugh, M.D., Catrine Bank, Shields road, Pollokshields. 1898
Kelly, J. H., J.P., Parkhead. 1900
Kelly, James K., M.D., F.F.P.S.G., Park villa, Queen Mary avenue, Crosshill. 1889
Kelly, John Davidson, M.A., Stanley house, Bridge-of-Allan. 1901
455 Kemp, Wm (Alexander, Fergusson, & Co., Ltd), Ruchill, Maryhill. 1898
*a*Kennedy, Alexander, Kenmill House, Bothwell. 1902
Kennedy, James, 33 Greendyke st. 1889
*a*Kennedy, Moses Hunter, 217 West George street. 1901
*a*Kennedy, William, Partick, 13 Victoria crescent, Dowanhill. 1900
460 *a*Ker, Charles, M.A., C.A., 155 St Vincent street. 1885
*a*Ker, Wm, 1 Windsor ter., West. 1874
Kerr, Geo. Munro, 97 Buchanan st. 1890
Kerr, John G., M.A., LL.D., 15 India street. 1878
Key, William, 109 Hope street. 1877
465 Kidston, Geo. J., Finlaystone, Langbank. 1900

*a*Kidston, William H., 81 Great Clyde street. 1900
Kiep, Johannes N., Imperial German Consul, 128 St Vincent street. 1900
*a*King, Chas M., Antermony house, Milton of Campsie. 1900
King, Sir James, Bart, LL.D., of Campsie, 115 Wellington street. 1855
470 King, John, 7 Queen's crescent. 1895
King, John C., 21 Newton place. 1898
Kirk, Robert, M.D., Newton cottage, Partick. 1877
Kirkpatrick, Alexander B., 88 St Vincent street. 1885
Kirkwood, James, Carling lodge, Ibrox. 1890
475 Knight, James, M.A., B.Sc., F.C.S., F.G.S., F.E.I.S., The Shieling, Uddingston. 1893
Knight, John, M.B., C.M., D.P.H. (Camb.), 2 Clydeford dr., Tollcross. 1900
*a*Knox, David J., 19 Renfield street. 1890
Knox, John, Finnieston School. 1900

Laird, John, Royal Exchange Sale Rooms. 1879
480 Lamb, David, 155 Hyndland road, W. 1896
Lamberton, Alex., 8 Adelphi terrace. 1900
Lamberton, Hugh, Lylestone, Pollokshields. 1901
*a*Lamberton, Hugh, John Gray & Co., Ltd., Adelphi terrace. 1900
Lambie, Robert, Strathview, Larkhall. 1901
485 Lamond, Robert, M.A., LL.B., 163 West George street. 1894
Lamont, Alexander, Kelvinhaugh Public School, 10 Ardgowan terrace, Sandyford. 1900
Lang, William, F.C.S, Crosspark, Partick. 1865
Lang, W. R., D.Sc., Professor of Chemistry in the University of Toronto, Canada. 1899
Laughland, David, 11 Newton terr. 1901
490*a*Lauder, James, F.R.S.L., Glasgow Athenæum. 1892
*a*Lauder, John, 46 Gordon street. 1894
Laurie, Malcolm, B.A., D.Sc., F.L.S., Professor of Zoology (St Mungo's College), Clunaline, Lenzie. 1901
Law, James H., Brandon House, Ibrox. 1901
Law, John, R. K., 20 Ashton gardens, Dowanhill. 1896
495*a*Lawson, Thomas, Birchgrove, Pollokshields. 1901
Lee, William, M.A., F.E.I.S., teacher, 298 Cumbernauld road. 1901
Leipper, James, 12 Park drive, Whiteinch. 1902
*a*Lindsay, Archd M., M.A., 87 West Regent street. 1872
Lindsay, John, City Chambers. 1897
500 Lindsay, William A., M.A., B.Sc., Lecturer, F.C. Training College, Glasgow, 4 Lloyd street, Dennistoun. 1900
Lothian, Alex. V., M.A., 11 Holborn terrace. 1891
Love, James Kerr, M.D., C.M., 10 Newark drive. 1888
Love, William, 28 Royal Exchange square. 1901
*a*Low, Isaac, 60 Weaver street. 1898
505 Lumsden, Harry, M.A., LL.B., 105 West George street. 1900
Lundholm, C. O., Nobel's Explosives Factory, Ardeer, Stevenston. 1890

MacAndrew, Francis Glen, of Knock, Knock Castle, Largs. 1901
M'Ara, Alexander, 65 Morrison street. 1888
Macara, James, 19 Waterloo street. 1901
510 Macara, Mudie, 1 Belmont street. 1901
M'Arly, Thomas, 29 West George st. 1897
MacArthur, J. G., Rosemary villa, Bowling. 1874
*a*M'Arthur, John S., 45 Renfield st. 1890
Macaulay, C. E. (Colonel), 2 Cathedral square. 1901
515 Macbean, Ed, F.R.G.S., F.R.S.L., Rannochlea, St Andrew's drive, Pollokshields. 1901
M'Bryde, Peter, M.B., 18 Queen's crescent, W. 1900
M'Callum, Hugh, M.A., Shields Road School. 1902
M'Callum, Robert, jun., 69 Union street. 1891
*a*M'Clelland, Andrew Simpson, C.A., 4 Crown gardens, Dowanhill. 1884
520 M'Conville, John, M.D., 27 Newton place. 1870
M'Cosh, Andrew K., Cairnhill, Airdrie. 1901
*a*M'Cowan, David, jun., 6 Eton gardens, 1898
M'Cracken, James, 5 Bowmont terrace, Kelvinside. 1889
M'Crae, John, 7 Kirklee gardens, Kelvinside. 1876
525 M'Creath, James, M.E., 208 St Vincent street. 1874
M'Culloch, Hugh, 154 West Regent street. 1880
M'Donald, Alexander, M.A., 14 Carmichael place, Langside. 1900

M'Donald, Alexander Beith, M.Inst. C.E., city engineer, City Chambers. 1901
*a*M'Donald, David, 34 Huntly gardens, Kelvinside. 1897
530 Macdonald, James A., H.M. Inspector of Schools, 23 Doune terrace. 1901
*a*M'Donald, John, 72 Great Clyde street. 1896
Macdonald, John King, J.P., 4 Hillend gardens, Partickhill. 1900
M'Dougall, Daniel Douglas, 2 Kingsborough gardens, Kelvinside. 1899
*a*Macdougall, Robert, F.S.A.A., F.S.I., 138 West Regent street. 1900
535 M'Elligott, John, 4 Victoria drive, Mount Florida. 1901
*a*M'Ewen, Robert, 11 Park terrace. 1900
*a*Macfarlane, Walter, 22 Park circus. 1885
M'Farlane, Wm, Edna Lodge, Rutherglen. 1888
*a*M'Gilvray, R. A., 129 West Regent street. 1880
540 M'Gregor, A. N., M.D., 121 Douglas street. 1900
*a*Macgregor, R. D., 137 West George street. 1900
Machell, Thomas, 1 Burnbank ter. 1886
M'Houl, David, Ph.D., Dalquhurn, Works, Renton. 1883
*a*Macindoe, Alex., 104 West George street. 1894
545 Macintyre, John, M.B., C.M., 179 Bath street. 1895
*a*M'Intyre, T. W., 21 Bothwell street. 1900
M'Intyre, Wm, F.E.I.S., Appin, Melrose avenue, Rutherglen. 1888
M'Kail, David, M.B., Ch.B., 483 London road. 1901
*a*M'Kechnie, D., 14 Candleriggs. 1900
550 M'Kellar, John C., 103 Bath street. 1896
M'Kellar, J., 25 Kelvinside terrace. 1893
*a*M'Kendrick, John G., M.D., C.M., LL.D., F.R.S., F.R.S.E., F.R C.P.E., Professor of Physiology in the University of Glasgow, 2 Buckingham terrace, *Hon. Vice-President*. 1877
M'Kendrick, J., Souttar, M.D., F.R.S.E., 2 Buckingham terrace. 1900
Mackenzie, John Alexander, M.B., C.M., 4 Carmichael place, Langside. 1900
555 Mackenzie, Thomas Riach, 16 Robertson street. 1901
*a*M'Kenzie, W. D., 43 Howard street. 1875
M'Kie, John, M.B., C.M., Florence bank, Springburn. 1899
Mackillop, Fred. G., M.A., LL.B., 128 St Vincent street. 1901
*a*Mackinlay, James Murray, The Lee, Merchiston, Edinburgh, 1886
560*a*Mackinlay, J. T. C., 210 Nithsdale road, Pollokshields. 1900
*a*Mackinlay, R. W., 52 Aytoun road, Pollokshields. 1900
Mackintosh, Donald J., M.B., C.M., Western Infirmary, 1894
Maclae, A. Crum, 147 St Vincent street. 1884
Maclaren, Norman H. W., demonstrator, Zoological Laboratory, University. 1900
565 M'Laren, Robert, Royal Bank, Garscube cross. 1898
M'Laren, William, 7 Westbank quadrant, Hillhead. 1899
MacLachlan, Dugald, B.L., 28 Renfield street. 1901
MacLaurin, Robert, 39 Caldercuilt road 1895
M'Lay, James, C.A., 94 Hope street. 1900
570 MacLay, Professor Alex., B.Sc., C.E , Camptower, Bearsden. 1901
Maclay, W., Thornwood, Langside. 1893
M'Lean, Angus, B.Sc., C.E., Principal, Technical School, Paisley. 1897
Maclean, A. B., Craigpark Works, Dennistoun. 1899
M'Lean, Charles R., L.R.C.P.E., L.R.P.S.G., 15 Annfield place, Dennistoun. 1900
575 Maclean, Magnus, M.A., F.R.S.E., D.Sc., Professor of Electrical Engineering, Glasgow and West of Scotland Technical College, 51 Kersland terrace, Hillhead, *Vice-President*. 1885
*a*MacLehose, James J., M.A., 61 St Vincent street. 1882
*a*Macleod, A., 3 Dundas street. 1893
Macleod, Frederick Larkins, 21 Huntly gardens, Hillhead. 1901
Macleod, the Rev. Donald, B.A., D.D., 1 Woodlands terrace, 1900
580 MacLellan, Lewis, 5 Bowmont gard. 1899
*a*Maclellan, Peter, Glasgow Rubber Works, Maryhill. 1900
*a*Maclellan, Wm. Walter, 3 Montague terrace, Kelvinside. 1900
M'Michael, Thomas, M.A., 54 Windsor street. 1901
M'Millan, A. Lewis, M.D., C.M., 1 Rosebery terrace, Gt Western road. 1897
585 M'Millan, Archibald, 34 Balshagray avenue, Partick. 1899

M'Millan, Robert, Methlan park, Dumbarton. 1901
*a*Macnab, James, Lilyburn, Milton of Campsie, Stirlingshire. 1901
Macnair, Andrew Duncan, Benvue, Dowanhill gardens. 1901
Macnair, John, 130 Claythorn street, and 1 Morris place, Monteith row. 1900
590 Macnair, Matthew, 1 Morris place, Monteith row. 1901
M'Nish, Robert, 14 Carrick street. 1901
Maconechy, Robert, Regent Park, Prestwick, Ayrshire. 1900
Macphail, Donald, M.D., Garturk cottage, Whifflet, Coatbridge. 1877
Macpherson, Duncan, Rosemount School. 1900
595 M'Raith, James N., 4 Queen's square, Strathbungo. 1900
M'Vail, D. C., M.B., Professor of Clinical Medicine, St Mungo's College, 3 St James' terrace, Hillhead. 1873
Macwhannell, Ninian, 58 West Regent street. 1898
M'Whirter, W., 9 Walworth terrace. 1901
Main, Robert B., 56 Dalziel drive. 1885
600 Malloch, A. M., Firhill, Garscube road. 1896
*a*Mann, James, 4 University gardens. 1900
Mann, John, C.A., 142 St Vincent street, 1856
Mann, John, jun., M.A., C.A., 142 St Vincent street 1885
Mann. Ludovic MacLellan, 142 St Vincent street. 1897
605*a*Mann, Robert M., 3 Montgomerie crescent. 1900
Manwell, James, The Hut, 4 Albert drive, Pollokshields. 1876
Marks, Samuel, 145 Great Eastern road. 1884
Marr, John, J.P., Dunjarg, Bellahouston, Govan. 1900
Marr, Hamilton Clelland, M.D., Woodilee Asylum, Lenzie. 1899
610 Marshall, James, Woodcroft, Crow road, Partick. 1900
*a*Marshall, Robt., 97 Wellington street. 1900
Martin, Jas F., 63 Brunswick st. 1895
Martin, John, writer, 58 West Regent street. 1901
Martin, Robert, 8 Burnbank terrace, W. 1897
615 Marwick, Sir J. D., LL.D., F.R.S.E., 19 Woodside terrace. 1878
Mathie, George M., 15 Dunard road, Rutherglen. 1895
Mathieson, J. H., 3 Grosvenor ter., Kelvinside. 1896
Mathieson, T. O., 3 Grosvenor ter. 1896
Mavor, Henry A., 47 King street, Mile-end. 1887
620 Mavor, Samuel, 37 Burnbank gard. 1890
Maxton, J., 27 Cedars road, Clapham common, London, S.W. 1900
May, A. H., 1 Crown circus, Dowanhill. 1898
Mayer, John, Strathview, Cathkin road, Langside. 1860
Mechan, Arthur, 60 Elliot street. 1876
625 Mechan, Henry, Scotstoun Iron Works, Scotstoun. 1879
Medley, Prof. Dudley J., of the University, 6 University gardens. 1901
Melville, George, 14 Princes square. 1901
Menzies, Thos, Hutchesons' Grammar School, Crown street. 1859
Menzies, William Crawford, City Improvement Trust, 34 Trongate. 1895
630 Metcalfe, John Ramsay, 19 Montgomery quadrant. 1901
Millar, A. D., H.M. Inspector of Schools, 20 Wilson street, Hillhead. 1901
Millar James, 158 Parliamentary rd. 1870
*a*Miller, Alexander Wingate, 79 West Nile street. 1900
Miller Alexander, jun., Broomhill, Partick. 1899
635 Miller, A. Lindsay, 122 Wellington street. 1878
*a*Miller, Arch. Russell, Castlebank, Bothwell. 1884
Miller, Hugh, M.A., 3 Westminster terrace, Ibrox. 1901
Miller, James, 5 Hanover street. 1900
Miller, Major, David S., 8 Royal crescent, W. 1887
640*a*Miller, George, Winton drive, Kelvinside. 1881
Miller, G. J., Frankfield, Shettleston. 1888
*a*Miller, J. C., 40 West Nile street. 1900
Miller, John, M.D., 323 Springburn road. 1900
*a*Miller, Thomas Hodgson, 17 Bute gardens, Hillhead. 1901
645*a*Miller, Thos P., Cambuslang Dyeworks. 1864
Mirrlees, James B., Redlands, Kelvinside. 1866
*a*Mirrlees, William J., 45 Scotland st. 1889
Mitchell, Alexander Brown, Avon Bank house, Larkhall. 1901
Mitchell, Andrew, C.A., The Glasgow District Subway Co., St Enoch square Station. 1896
650*a*Mitchell, George A., F.R.S.E., 5 West Regent street. 1883
Mitchell, Nelson, 3 Great Western terrace. 1898
Mitchell, Wm James, M.A., B.L., 49 West George street. 1897

Mitchell, J. O., LL.D, 7 Huntly gardens. 1899
*a*Moffatt, Alexander, 23 Abercromby place, Edinburgh. 1874
655 Mollison, James, 30 Balshagray aven., Partick. 1889
*a*Mond, Robert Ludwig, B.A. (Cantab.), F.R.S.E., 20 Avenue road, Regent's park, London, N.W. 1890
*a*Monro, T. K., M.A., M.D., F.F.P.S.G., 10 Clairmont gards. 1897
*a*Monteith, Robert, Greenbank, Dowanhill gardens. 1885
Moore, Alexander, C.A., 50 Montgomerie drive, Kelvinside. 1869
660 Moore, Alexander George, M.A., B.Sc., 13 Clairmont gardens. 1886
Morrice, Jas A., 1 Prince's ter., Dowanhill. 1883
Motion, James Russell, 38 Cochrane street. 1887
Motion, Thomas Mason, 6 Melrose street, Great Western road. 1897
Muir, Alex., 400 Eglinton street. 1883
665*a*Muir, Allan, Ardmay, Newlands road, Langside. 1881
Muir, Matthew Greenlees, 12 Waterloo street. 1901
Muir, Sir John, Bart, 22 West Nile street. 1876
Muir, Robert, M.D., F.R.C.P.E., Professor of Pathology in Glasgow University, 4 Alfred terrace, Hillhead. 1899
*a*Muirhead, Andrew Erskine, Cart Forge, Crossmyloof. 1873
670 Muirhead, James, 2 Bowmont gardens, Kelvinside. 1887
*a*Muirhead, Robert F., M.A., B.Sc., 24 Kersland street, Hillhead. 1879
Munro, Alexander, M.B., C.M., 569 Gallowgate. 1900
Munro, Daniel, F.S.I., 10 Doune terrace, Kelvinside. 1867
Munro, Donald Mackay, 88 St Vincent street. 1901
675 Munro, J. M. M., M.Inst. E.E., M.Inst.C.E., F.R.S.E., 136 Bothwell street. 1896
Munsie, George, 109 Virginia place. 1871
Munsie, Robert George, 109 Virginia place. 1883
Murdoch, George, 40 St Vincent place. 1894
Murdoch, John, writer, 208 West George street. 1901
680*a*Murdoch, Robert, 91 Maxwell road. 1880
*a*Murray, Daniel, 5 Wilton crescent. 1896
*a*Murray, David, LL.D., 105 West George street. 1876
Murray, James, 144 Craigpark street, Dennistoun. 1901
Murray, John Bruce, 24 George square. 1890
685 Murray, James, 144 Craigpark, Dennistoun. 1901
Napier, Alex., M.D., F.F.P.S.G., Rose Bank, Queen Mary avenue, Crosshill. 1886
Napier, James, M.A., F.R.S.E., The Drums, Old Kilpatrick. 1900
Napier, Robert T., 75 Bothwell street, Glasgow. 1899
Neilson, Archibald Garibaldi, 9 Hillside gardens, Partickhill. 1901
690*a*Neilson, George, 34 Granby ter. 1897
*a*Neilson, James, 116 Bishop street, Port-Dundas. 1896
*a*Neilson, John, Mollance, Castle-Douglas. 1900
*a*Neilson, Walter, Ewenfield, Ayr. 1900
Neilson, William, 27 Robertson street, Greenock, 1899
695 Nelson, Alex., 80 Gordon street. 1880
*a*Nelson, John E., 26 Queen street. 1900
Nelson, Thos C., Craiglea, Dennistoun. 1900
*a*Newlands, Joseph F., 28 Renfield st. 1883
Nicol, James Monro, 93 Cheapside street. 1901
700 Nicoll, James H., M.B., 4 Woodside place. 1897
Nish, Robert, 9 Claremont terrace. 1897

Orr, George Smith, 58 Renfield street. 1901
Orr, John, 107 Wellington street. 1901
Orr, Robert, 79 West Nile street. 1890
705*a*Osborne, Hugh, 4 Kew terrace, Glasgow. 1899

Palgrave, A. G., 17 Wilton mansions, Kelvinside, N. 1900
Park, James, 51 Milburn street. 1877
*a*Park, Lieut.-Colonel James Smith, V.D., 61 Hamilton drive. 1900
Park, Robert, M.D., 40 Grant street. 1894
710 Parker, Edward H., 11 Strathmore gardens, Hillhead. 1897
*a*Parker John Dunlop, C.E., 146 West Regent street. 1889
Parker, James H., B.L., C.A., 89 West Regent street. 1900
*a*Painie, William, 27 Union street. 1897
Parry, Robert Henry, F.R.C.S.E., 3 Royal crescent, Queen's Park. 1900
715*a*Paterson, Robert, C.A., 28 Renfield street. 1881
Paterson, Wm, 43 Millbrae Road, Langside. 1902

Paton, James, F.L.S., Corporation Galleries and Kelvingrove Museum. 1876

Patrick, Joseph, M.A., C.A., 203 West George street. 1893

Patrick, Joseph, of Alex. Kay & Co., Royal Exchange buildings. 1900

720 Patterson, T. L., F.C.S., Maybank, Finnart street, Greenock. 1873

Peacock, T. Reid, 122 Wellington street. 1898

Peck, James W., M.A., Arnott Demonstrator in Natural Philosophy, Glasgow University, Newington, South Brae drive. 1899

Petrie, Alexander, I.A., 134 Wellington street. 1885

Petrie, John W., 83 Oxford drive. 1900

725 Pettigrew, Andrew H., Chesters, Bearsden. 1902

Pinkerton, John, M.D, Q.H.P., Surgeon-General, Queen's Park House, Langside. 1900

*a*Pirrie, Robert, 9 Buckingham ter. 1875

Playfair, David James, 7 Victoria crescent, Dowanhill. 1901

Pollock, A. Barr, 3 Belgrave terrace, Hillhead. 1897

730 *a*Pollock, R., M.B., C.M., F.F.P.S.G., Laurieston house, Pollokshields. 1883

Powell, James, Newlands School. 1900

Procter, Robert, Claremont, Alloa. 1901

*a*Provan, James, 92 West Nile st. 1868

Provand, A. D., M.P., 2 Whitehall court, London, S.W. 1888

735 Raalte, Jacques Van, Baltic Chambers, 50 Wellington street. 1884

Raleigh, Professor Walter, M.A., of Glasgow University, 2 South Park terrace. 1901

*a*Ralston, William Henry, 4 North Court, Royal Exchange. 1900

Ramsay, G. G., LL.D., Litt. D., Professor of Humanity in Glasgow University, 6 The College. 1900

Ramsay, William, 11 Wilton mansions, Kelvinside, 1899

740 Ramsey, Robert, 14 Park terrace. 1889

*a*Ramsey, Robert, jun., 14 Park terrace. 1898

Rankin, The Rev. W. M., B.D., clergyman, 8 Craigpark, Dennistoun. 1900

Rankine, Adam, Russell, Macfarlane & Co., Ltd., 47 Queen street. 1901

Rankine, David, C.E., 238 West George street. 1875

745 Rattray, Rev. Alex., M.A., Parkhead Parish, 4 Westercraigs, Dennistoun. 1879

Rattray, William A., 233 Hope st. 1890

*a*Reid, Andrew Thomson, 10 Woodside terrace. 1900

Reid, David, 16 Cambridge street. 1887

*a*Reid, Hugh, Belmont, Springburn. 1880

750 Reid, James, 15 Montgomerie crescent. 1886

*a*Reid, Joseph, 32 Newark drive, Pollokshields. 1901

*a*Reid, Nicholas M'Whirter, 7 Oakley terrace, Dennistoun. 1901

Reid, Robert, C.A., 40 St Vincent place. 1900

Reid, Thos, M.D., LL.D., 11 Elmbank street. 1869

755 Reid, William, M.A., 61 Grant street. 1881

*a*Reid, William L., M.D., 7 Royal crescent, West. 1882

Reith, Rev. George, M.A., D.D., Free College Church, 37 Lynedoch street. 1876

Renton, James Crawford, M.D., L.R.C.P. & S.Ed., 1 Woodside terrace. 1875

*a*Rennie, John, Wellcroft, Helensburgh. 1901

760 *a*Renwick, Wm, Langgarth, Stirling. 1901

Rey, Hector, B.L., B.Sc., 59 Cecil street, Hillhead. 1889

Richmond, Thos, L.R.C.P.E., 22 Holyrood crescent. 1887

Rigg, R. A., 95 Buchanan street. 1900

Ritchie, Geo., Parkhead Forge and Steel Works. 1890

765 Robb, George, carting superintendent, Caledonian Railway. 1901

Robb, John, Busby house, Busby. 1897

Robb, William, F.R.C.V.S., 6 Canning place, Stirling road. 1900

*a*Roberton, William, 209 Sauchiehall street, Glasgow. 1899

Robertson, Alex., M.D., F.F.P.S.G., 11 Woodside crescent. 1900

770 *a*Robertson, Henry Tod, Meadowbank, Airdrie. 1901

Robertson, John, Woodside school, and Endcliffe, Langside, *Hon. Lib.* 1860

Robertson, J. M'Gregor, M.A., M.B., C.M., 26 Buckingham ter., Hillhead. 1881

Robertson, Mure, M.E., 4 Clairmont gardens. 1897

*a*Robertson, Robert, B.Sc., M.Inst. C.E., M.I.E.E., etc., 154 West George street. 1900

775 Robertson, Robert H., Clyde bank, Rutherglen. 1888

Robertson, William, C.E., 121 St Vincent street. 1869

Robertson, Wm, 15 Gordon street. 1900

Robinson, Rev. Alexander, M.A., B.D., Auchengray, Crieff. 1901
Robinson, Thomas, The Villas, Hurlet, Nitshill. 1901
780 Rodger, Anderson, Glenpark, Port-Glasgow. 1899
Roemmele, C. H., 34 Kelvinside gardens. 1900
*a*Rogers, John C., 224 St Vincent street. 1888
Rose, Alexander, Richmond house, Dowanhill. 1879
Rose, Hugh, 26 Eglinton drive. 1900
785*a*Ross, John, 9 Westbourne gardens. 1885
Ross, John Munn, C.A., 115 Wellington street. 1894
Ross, Russell James, manager, Parkhead Steel Works, 8 Ashfield gardens, Jordanhill. 1901
Ross, William, 10 Regent place, Shawlands. 1893
*a*Rottenburg, Paul, LL.D., 55 West Regent street. 1872
790 Rowan, James, 22 Woodside place. 1897
Rowan, John, M.B., F.F.P.S.G., 9 Blythswood square. 1900
Rowan, W. G., 234 West George street, 1881
*a*Rowley, Thos, Campbell street, Govan. 1901
Runciman, Alex., 45 Renfield street. 1900
795 Rundell, R. Cooper, Underwriters' Room, Royal Exchange. 1877
Russell, Robert, M.E., Coltness Iron Co., Ltd., Newmains, Lanarkshire. 1901

Salmon, W. Forrest, F.R.I.B.A., 53 Bothwell street. 1870
*a*Samuel, John Smith, secretary to the Lord Provost of Glasgow, City Chambers. 1901
Sandeman, B., Ferndean, Lenzie. 1900
800 Sawers, William D., Assoc.I.C., Athole gardens. 1894
Sayers, William Brooks, M.I.E.E., 189 St Vincent street. 1890
Schmidt, Alfred, 508 New City road. 1881
Scott, Alexander, M.D., Waverley Lodge, Tollcross. 1900
Scott, Alex., 34 Lawrence street, Dowanhill. 1871
805*a*Scott, D. M'Laren, 2 Park quadrant. 1881
Scott, John, 245 Sauchiehall street. 1892
Scott, Robert, I.M., 155 Wellington street. 1884
Scott, Robert, 8 Buchanan street. 1901
Scougal, Andrew E., M.A., 14 Kelvin Drive, Kelvinside, N. 1899
810 Seligmann, Hermann L., 59 St Vincent street. 1850
Seligmann, Hermann Leo, Jun., 105 West George street. 1900
Sellar, Charles, B.L., 65 Bath street. 1901
*a*Service, Edward, 92 St Vincent street. 1901
Service, R. Gibson, 14 Royal Exchange buildings. 1900
815*a*Service, William, 1 Queen's gate, Dowanhill. 1900
Sexton, A. Humboldt, F.C.S., F.I.C., F.R.S.E., Professor of Metallurgy, Glasgow and West of Scotland Technical College, 204 George street. 1892
*a*Shanks, J. B., 46 Gordon street. 1900
Shanks, John Cochrane, 26 West Nile street. 1899
*a*Shaw, A. M'Innes, 8 Kelvinside terrace, N. 1900
820 Shaw, William, 17 Woodside crescent. 1900
*a*Shearer, Wm, 108 St Vincent street. 1901
*a*Sherriff, George, Carronvale, Larbert, Stirlingshire. 1900
Shields, Daniel, 104 West George street. 1900
Simons, Michael, 206 Bath street. 1880
825 Simons, William, M.I.N.A., Sherbrook, Tighnabruaich, Argyllshire. 1900
*a*Simpson, J. C., M.D., 9 Marlborough terrace, Kelvinside. 1896
Sinclair, Alexander, Ajmere lodge, Langside. 1883
Sinclair, John, 150 Buchanan st. 1898
Sloan, George, 53 Bothwell street. 1900
830 Sloan, Samuel, M.D., 5 Somerset place.
Sloane, F. N., C.A., 187 West George street. 1893
Smart, William, M.A., LL.D., Professor of Political Economy, University of Glasgow, Nunholm, Dowanhill. 1886
Smellie, George, I.M., 167 St Vincent street. 1880
Smellie, James, I.M., 112 Bath street. 1901
835*a*Smith, Andrew, Miltonlea, Kilmalcolm. 1901
Smith, Colonel J. N., V.D., Dykebar house, Hawkhead, Paisley. 1900
Smith, D. Johnstone, C.A., 149 W. George street. 1888
*a*Smith, Fred. J., 40 St Vincent place. 1901
Smith, George, 1 Annfield terrace, East Partick. 1901

840 Smith, Hugh C., 55 Bath street. 1861
*a*Smith, J. Guthrie, 205 St Vincent street. 1875
*a*Smith, James Murray, 11 Bute gardens. 1901
Smith, Patrick A., M.D., F.F.P.S.G., J.P., Dundrennan, 50 Queen Mary avenue, Crosshill. 1900
*a*Smith, Robert B., Bonnybridge, Stirlingshire. 1884
845*a*Smith, W.B., 34 Buchanan street. 1895
Snodgrass, J. F., Ashbourne, Winton drive, Kelvinside. 1900
Snodgrass, William, M.A., M.B., C.M., F.F.P.S.G., 11 Victoria cres., Dowanhill. 1890
*a*Somerville, Alex., B.Sc., F.L.S., 4 Bute mansions, Hillhead. 1888
Sorley, Robert, 93 St Vincent st. 1878
850*a*Spencer, Charles L., Edgehill, Kelvinside. 1891
*a*Spencer, J. J., Edgehill, Kelvinside. 1895
Spens, John A., 105 W. George street. 1879
Steel, James, M.A., 502 St Vincent street. 1901
*a*Steel, William Strang, Philiphaugh, Selkirk. 1889
855*a*Stephen, John, Domira, Partick 1880
Sterling, John Lockhart, 30 Ashton gardens, 1901
Steven, Alexander Kay, Westmount, Kelvinside. 1897
Steven, Henry, 20 Ingram street. 1900
*a*Steven, Hugh, Westmount, Montgomerie drive. 1869
860 Steven John, 32 Elliot street. 1875
Steven, J. H., Beechcroft, Stirling. 1897
*a*Stevenson, D. M., 12 Waterloo street. 1889
*a*Stevenson, Jas, LL.D., F.R.G.S., 23 West Nile street. 1870
Stevenson, John, 41 Albert terrace, Trinity, Edinburgh. 1892
865 Stevenson, Robert, M.D., 12 Merton road, Bootle. 1898
Stevenson, Samuel, 4 Royal terrace, Crosshill. 1902
Stevenson, Wm, 13 Carlton place. 1888
Steuart, Daniel Rankine, Osborne cottage, Broxburn, West Lothian. 1877
Stewart, Allan Alfred, 180 Hope street. 1901
870 Stewart, Archibald, Marnock villa, Queen's drive, Crosshill. 1892
Stewart, David, 3 Clifton place. 1856
Stewart, Duncan, 14 Windsor terrace, Kelvinside. 1901
Stewart, John, 220 Parliamentary road. 1899
Stewart, Robert, Newark, Partick. 1899
875*a*Stewart, Robertson Buchanan, 146 Argyle street. 1901
Stewart, Walter, jun., M.A., D.Sc., Chief Assistant to the Professor of Natural Philosophy, Glasgow University, Gartsherrie, Coatbridge. 1899
*a*Stewart, William, Kelvinhaugh street. 1901
*a*Stobo, Thomas, Somerset house, Garelochhead. 1884
Stockdale, H. F., Clairinch, Milngavie. 1899
880 Stockman, Ralph, M.D., F.R.S.E., Professor of Materia Medica, The University of Glasgow. 1897
Stoddart, James Edward, Howden, Mid-Calder, N.B. 1872
Story, The Very Rev. R. H., D.D., Principal of the University of Glasgow. 1899
Strachan, George, Fairfield Works, Govan. 1900
Strachan, R. U., Sheriff-Substitute, 10 Crown circus. 1896
885*a*Strain, James M., 15 Kingsborough gardens, W. 1900
*a*Strain, John, C.E., 154 W. George street. 1876
Strathie, David, C.A., 162 St Vincent street. 1895
*a*Sutherland, David, Balmaccara Hotel, Lochalsh. 1880
*a*Sutherland, John, Columba Hotel, Oban. 1880
890 Sutherland, J. R., C.E., 45 John street. 1884
Swan, Charles C., 15 Rose street, Garnethill. 1891

Tait, William, 43 Keir street, Pollokshields. 1902
Tatlock, John, F.I.C., 13 Parkgrove terrace, West, Sandyford. 1875
Tatlock, Robert R., F.R.S.E., F.I.C., F.C.S., 156 Bath street. 1868
895 Taylor, Benjamin, F.R.G.S., 10 Derby crescent, Kelvinside. 1872
Taylor, J. M., Dean of Faculty of Procurators, Northbank, Kelvinside. 1900
*a*Teacher, John H., M.B., C.M., 32 Huntly gardens. 1898
Temple, Edwin, B.A.Cantab., Rector of Glasgow Academy. 1899
Templeton, James, 2 Claremont terrace. 1900
900Templeton, John Stewart, William street, Calton. 1900
Tennant, Sir Charles, Bart, 142 West Nile street. 1868

400 Hendry, Geo. Scott, 87 Bothwell st. 1895
Henry, R. W., 9 Parkgrove ter., W. 1875
Heys, Zechariah J., South Arthurlie, Barrhead. 1870
Higgins, Henry, jun., 248 West George street. 1878
Hinshelwood, James, M.A., M.D., 26 Woodside place. 1896
405 Hodge, James R., C.A., 105 West George street. 1900
Hodge, William, 27 Montgomerie drive, Kelvinside. 1878
Hogg, Robert, 163 Nithsdale road, Pollokshields. 1865
Holmes, Daniel T., B.A., Woodburn, Kilmalcolm. 1898
Honeyman, P. S., 12 South Park terrace. 1900
410 Hood, Archibald J., M.A., 2 Kelvingrove terrace, 1901
*a*Hope, James, Dean house, Lenzie. 1898
Horne, Joseph, M.B., C.M., 5 Windsor street. 1900
*a*Houldsworth, J. H., Rozelle, Ayr. 1900
*a*Houldsworth, Wm Thos, Clerk in Holy Orders, 1 Mansfield street, Portland place, London, W. 1901
415 Houstoun, Wm Henry, Hillcrest, Cambridge drive. 1895
Howat, William, 37 Elliot street. 1885
Hunt, Edmund, 121 W. George st. 1856
*a*Hunt, John, Milton of Campsie. 1881
Hunter, James, 89 Mitchell street. 1900
420 Hunter, Richard H., Glentyan, Kilbarchan, Renfrewshire. 1900
Hunter, Robert, 72 Waterloo street. 1901
Hunter, the Rev. John, D.D., London. 1899
Hunter, Walter K., M.D., 1 Newton terrace, Glasgow. 1899
*a*Hunter, Wm S., 70 Robertson st. 1889
425 Hutchison, John C., 8 Lansdowne crescent. 1900
Hutchison, Joseph, Woodside, Netherburn, Lanarkshire. 1901
Hutton, James, C.A., 203 West George street. 1897
Hutton, W. K., M.A., M.B., Senior Demonstrator of Anatomy, The University. 1900
*a*Hyslop, William, of Bank, New Cumnock. 1901

430 Inglis, John, LL.D., Pointhouse Shipyard. 1895
*a*Inglis, Malcolm, 48 St Andrew's sq. 1900
Inglis, R. A., Culrain, Bothwell, 1889
Innes, Gilbert, 27 Hamilton drive, Hillhead. 1900
Inverclyde, Lord, The Right Hon., Castle Wemyss, Wemyss Bay. 1900

435 Jack, William Robert, M.D., 43 Lansdowne crescent. 1899
*a*Jack, William, M.A., LL.D., Professor of Mathematics in the University of Glasgow. 1881
Jackson, Robert, 16 Dixon avenue, Crosshill. 1902
Jackson, Thomas, C.A., 24 George square. 1900
Jamieson, Andrew, F.R.S.E., M.Inst.C.E., M.Inst.E.E., etc., 16 Rosslyn terrace, Kelvinside. 1881
440 Jenkins, James Graham, Airedale, Cambuslang. 1901
Jenkins, Thomas, Woodlands, Crosshill. 1901
Johnston, Alex., M.D. (Glasgow), D.P.H. (Camb)., Ruchill Hospital. 1900
Johnston, David, 160 West George street. 1891
Johnston, George, Mosesfield, Springburn. 1896
445 Johnston, William G., 18 Coatbridge street, Port Dundas. 1901
Johnstone, Jas, Coatbridge street, Port-Dundas. 1869

Kay, Cathcart, 77 St Vincent st. 1900
Kay, Thomas, M.B., C.M., 5 Rosebery street. 1899
Kean, James, 32 Scotia street, Garnethill. 1888
450*a*Kelly, Alexander, 100 Hyde Park street. 1901
Kelly, Hugh, M.D., Catrine Bank, Shields road, Pollokshields. 1898
Kelly, J. H., J.P., Parkhead. 1900
Kelly, James K., M.D., F.F.P.S.G., Park villa, Queen Mary avenue, Crosshill. 1889
Kelly, John Davidson, M.A., Stanley house, Bridge-of-Allan. 1901
455 Kemp, Wm (Alexander, Fergusson, & Co., Ltd), Ruchill, Maryhill. 1898
*a*Kennedy, Alexander, Kenmill House, Bothwell. 1902
Kennedy, James, 33 Greendyke st. 1889
*a*Kennedy, Moses Hunter, 217 West George street. 1901
*a*Kennedy, William, Partick, 13 Victoria crescent, Dowanhill. 1900
460*a*Ker, Charles, M.A., C.A., 155 St Vincent street. 1885
*a*Ker, Wm, 1 Windsor ter., West. 1874
Kerr, Geo. Munro, 97 Buchanan st. 1890
Kerr, John G., M.A., LL.D., 15 India street. 1878
Key, William, 109 Hope street. 1877
465 Kidston, Geo. J., Finlaystone, Langbank. 1900

*a*Kidston, William H., 81 Great Clyde street. 1900
Kiep, Johannes N., Imperial German Consul, 128 St Vincent street. 1900
*a*King, Chas M., Antermony house, Milton of Campsie. 1900
King, Sir James, Bart, LL.D., of Campsie, 115 Wellington street. 1855
470 King, John, 7 Queen's crescent. 1895
King, John C., 21 Newton place. 1898
Kirk, Robert, M.D., Newton cottage, Partick. 1877
Kirkpatrick, Alexander B., 88 St Vincent street. 1885
Kirkwood, James, Carling lodge, Ibrox. 1890
475 Knight, James, M.A., B.Sc., F.C.S., F.G.S., F.E.I.S., The Shieling, Uddingston. 1893
Knight, John, M.B., C.M., D.P.H. (Camb.), 2 Clydeford dr., Tollcross. 1900
*a*Knox, David J., 19 Renfield street. 1890
Knox, John, Finnieston School. 1900

Laird, John, Royal Exchange Sale Rooms. 1879
480 Lamb, David, 155 Hyndland road, W. 1896
Lamberton, Alex., 8 Adelphi terrace. 1900
Lamberton, Hugh, Lylestone, Pollokshields. 1901
*a*Lamberton, Hugh, John Gray & Co., Ltd., Adelphi terrace. 1900
Lambie, Robert, Strathview, Larkhall. 1901
485 Lamond, Robert, M.A., LL.B., 163 West George street. 1894
Lamont, Alexander, Kelvinhaugh Public School, 10 Ardgowan terrace, Sandyford. 1900
Lang, William, F.C.S., Crosspark, Partick. 1865
Lang, W. R., D.Sc., Professor of Chemistry in the University of Toronto, Canada. 1899
Laughland, David, 11 Newton terr. 1901
490 *a*Lauder, James, F.R.S.L., Glasgow Athenæum. 1892
*a*Lauder, John, 46 Gordon street. 1894
Laurie, Malcolm, B.A., D.Sc., F.L.S., Professor of Zoology (St Mungo's College), Clunaline, Lenzie. 1901
Law, James H., Brandon House, Ibrox. 1901
Law, John, R. K., 20 Ashton gardens, Dowanhill. 1896
495 *a*Lawson, Thomas, Birchgrove, Pollokshields. 1901
Lee, William, M.A., F.E.I.S., teacher, 298 Cumbernauld road. 1901
Leipper, James, 12 Park drive, Whiteinch. 1902
*a*Lindsay, Archd M., M.A., 87 West Regent street. 1872
Lindsay, John, City Chambers. 1897
500 Lindsay, William A., M.A., B.Sc., Lecturer, F.C. Training College, Glasgow, 4 Lloyd street, Dennistoun. 1900
Lothian, Alex. V., M.A., 11 Holborn terrace. 1891
Love, James Kerr, M.D., C.M., 10 Newark drive. 1888
Love, William, 28 Royal Exchange square. 1901
*a*Low, Isaac, 60 Weaver street. 1898
505 Lumsden, Harry, M.A., LL.B., 105 West George street. 1900
Lundholm, C. O., Nobel's Explosives Factory, Ardeer, Stevenston. 1890

MacAndrew, Francis Glen, of Knock, Knock Castle, Largs. 1901
M'Ara, Alexander, 65 Morrison street. 1888
Macara, James, 19 Waterloo street. 1901
510 Macara, Mudie, 1 Belmont street. 1901
M'Arly, Thomas, 29 West George st. 1897
MacArthur, J. G., Rosemary villa, Bowling. 1874
*a*M'Arthur, John S., 45 Renfield st. 1890
Macaulay, C. E. (Colonel), 2 Cathedral square. 1901
515 Macbean, Ed, F.R.G.S., F.R.S.L., Rannochlea, St Andrew's drive, Pollokshields. 1901
M'Bryde, Peter, M.B., 18 Queen's crescent, W. 1900
M'Callum, Hugh, M.A., Shields Road School. 1902
M'Callum, Robert, jun., 69 Union street. 1891
*a*M'Clelland, Andrew Simpson, C.A., 4 Crown gardens, Dowanhill. 1884
520 M'Conville, John, M.D., 27 Newton place. 1870
M'Cosh, Andrew K., Cairnhill, Airdrie. 1901
*a*M'Cowan, David, jun., 6 Eton gardens, 1898
M'Cracken, James, 5 Bowmont terrace, Kelvinside. 1889
M'Crae, John, 7 Kirklee gardens, Kelvinside. 1876
525 M'Creath, James, M.E., 208 St Vincent street. 1874
M'Culloch, Hugh, 154 West Regent street. 1880
M'Donald, Alexander, M.A., 14 Carmichael place, Langside. 1900

M‘Donald, Alexander Beith, M.Inst. C.E., city engineer, City Chambers. 1901
*a*M‘Donald, David, 34 Huntly gardens, Kelvinside. 1897
530 Macdonald, James A., H.M. Inspector of Schools, 23 Doune terrace. 1901
*a*M‘Donald, John, 72 Great Clyde street. 1896
Macdonald, John King, J.P., 4 Hillend gardens, Partickhill. 1900
M‘Dougall, Daniel Douglas, 2 Kingsborough gardens, Kelvinside. 1899
*a*Macdougall, Robert, F.S.A.A., F.S.I., 138 West Regent street. 1900
535 M‘Elligott, John, 4 Victoria drive, Mount Florida. 1901
*a*M‘Ewen, Robert, 11 Park terrace. 1900
*a*Macfarlane, Walter, 22 Park circus. 1885
M‘Farlane, Wm, Edna Lodge, Rutherglen. 1888
*a*M‘Gilvray, R. A., 129 West Regent street. 1880
540 M‘Gregor, A. N., M.D., 121 Douglas street. 1900
*a*Macgregor, R. D., 137 West George street. 1900
Machell, Thomas, 1 Burnbank ter. 1886
M‘Houl, David, Ph.D., Dalquhurn, Works, Renton. 1883
*a*Macindoe, Alex., 104 West George street. 1894
545 Macintyre, John, M.B., C.M., 179 Bath street. 1895
*a*M‘Intyre, T. W., 21 Bothwell street. 1900
M‘Intyre, Wm, F.E.I.S., Appin, Melrose avenue, Rutherglen. 1888
M‘Kail, David, M.B., Ch.B., 483 London road. 1901
*a*M‘Kechnie, D., 14 Candleriggs. 1900
550 M‘Kellar, John C., 103 Bath street. 1896
M‘Kellar, J., 25 Kelvinside terrace. 1893
*a*M‘Kendrick, John G., M.D., C.M., LL.D., F.R.S., F.R.S.E., F.R C.P.E., Professor of Physiology in the University of Glasgow, 2 Buckingham terrace, *Hon. Vice-President.* 1877
M‘Kendrick, J., Souttar, M.D., F.R.S.E., 2 Buckingham terrace. 1900
Mackenzie, John Alexander, M.B., C.M., 4 Carmichael place, Langside. 1900
555 Mackenzie, Thomas Riach, 16 Robertson street. 1901
*a*M‘Kenzie, W. D., 43 Howard street. 1875
M‘Kie, John, M.B., C.M., Florence bank, Springburn. 1899
Mackillop, Fred. G., M.A., LL.B., 128 St Vincent street. 1901
*a*Mackinlay, James Murray, The Lee, Merchiston, Edinburgh, 1886
560 *a*Mackinlay, J. T. C., 210 Nithsdale road, Pollokshields. 1900
*a*Mackinlay, R. W., 52 Aytoun road, Pollokshields. 1900
Mackintosh, Donald J., M.B., C.M., Western Infirmary, 1894
Maclae, A. Crum, 147 St Vincent street. 1884
Maclaren, Norman H. W., demonstrator, Zoological Laboratory, University. 1900
565 M‘Laren, Robert, Royal Bank, Garscube cross. 1898
M‘Laren, William, 7 Westbank quadrant, Hillhead. 1899
MacLachlan, Dugald, B.L., 28 Renfield street. 1901
MacLaurin, Robert, 39 Caldercuilt road 1895
M‘Lay, James, C.A., 94 Hope street. 1900
570 MacLay, Professor Alex., B.Sc., C.E , Camptower, Bearsden. 1901
Maclay, W., Thornwood, Langside. 1893
M‘Lean, Angus, B.Sc., C.E., Principal, Technical School, Paisley. 1897
Maclean, A. B., Craigpark Works, Dennistoun. 1899
M‘Lean, Charles R., L.R.C.P.E., L.R.P.S.G., 15 Annfield place, Dennistoun. 1900
575 Maclean, Magnus, M.A., F.R.S.E., D.Sc., Professor of Electrical Engineering, Glasgow and West of Scotland Technical College, 51 Kersland terrace, Hillhead, *Vice-President.* 1885
*a*MacLehose, James J., M.A., 61 St Vincent street. 1882
*a*Macleod, A., 3 Dundas street. 1893
Macleod, Frederick Larkins, 21 Huntly gardens, Hillhead. 1901
Macleod, the Rev. Donald, B.A., D.D., 1 Woodlands terrace, 1900
580 MacLellan, Lewis, 5 Bowmont gard. 1899
*a*Maclellan, Peter, Glasgow Rubber Works, Maryhill. 1900
*a*Maclellan, Wm. Walter, 3 Montague terrace, Kelvinside. 1900
M‘Michael, Thomas, M.A., 54 Windsor street. 1901
M‘Millan, A. Lewis, M.D., C.M., 1 Rosebery terrace, Gt Western road. 1897
585 M‘Millan, Archibald, 34 Balshagray avenue, Partick. 1899

M'Millan, Robert, Methlan park, Dumbarton. 1901

*a*Macnab, James, Lilyburn, Milton of Campsie, Stirlingshire. 1901

Macnair, Andrew Duncan, Benvue, Dowanhill gardens. 1901

Macnair, John, 130 Claythorn street, and 1 Morris place, Monteith row. 1900

590 Macnair, Matthew, 1 Morris place, Monteith row. 1901

M'Nish, Robert, 14 Carrick street. 1901

Maconechy, Robert, Regent Park, Prestwick, Ayrshire. 1900

Macphail, Donald, M.D., Garturk cottage, Whifflet, Coatbridge. 1877

Macpherson, Duncan, Rosemount School. 1900

595 M'Raith, James N., 4 Queen's square, Strathbungo. 1900

M'Vail, D. C., M.B., Professor of Clinical Medicine, St Mungo's College, 3 St James' terrace, Hillhead. 1873

Macwhannell, Ninian, 58 West Regent street. 1898

M'Whirter, W., 9 Walworth terrace. 1901

Main, Robert B., 56 Dalziel drive. 1885

600 Malloch, A. M., Firhill, Garscube road. 1896

*a*Mann, James, 4 University gardens. 1900

Mann, John, C.A., 142 St Vincent street, 1856

Mann, John, jun., M.A., C.A., 142 St Vincent street 1885

Mann. Ludovic MacLellan, 142 St Vincent street. 1897

605*a*Mann, Robert M., 3 Montgomerie crescent. 1900

Manwell, James, The Hut, 4 Albert drive, Pollokshields. 1876

Marks, Samuel, 145 Great Eastern road. 1884

Marr, John, J.P., Dunjarg, Bellahouston, Govan. 1900

Marr, Hamilton Clelland, M.D., Woodilee Asylum, Lenzie. 1899

610 Marshall, James, Woodcroft, Crow road, Partick. 1900

*a*Marshall, Robt., 97 Wellington street. 1900

Martin, Jas F., 63 Brunswick st. 1895

Martin, John, writer, 58 West Regent street. 1901

Martin, Robert, 8 Burnbank terrace, W. 1897

615 Marwick, Sir J. D., LL.D., F.R.S.E., 19 Woodside terrace. 1878

Mathie, George M., 15 Dunard road, Rutherglen. 1895

Mathieson, J. H., 3 Grosvenor ter., Kelvinside. 1896

Mathieson, T. O., 3 Grosvenor ter. 1896

Mavor, Henry A., 47 King street, Mile-end. 1887

620 Mavor, Samuel, 37 Burnbank gard. 1890

Maxton, J., 27 Cedars road, Clapham common, London, S.W. 1900

May, A. H., 1 Crown circus, Dowanhill. 1898

Mayer, John, Strathview, Cathkin road, Langside. 1860

Mechan, Arthur, 60 Elliot street. 1876

625 Mechan, Henry, Scotstoun Iron Works, Scotstoun. 1879

Medley, Prof. Dudley J., of the University, 6 University gardens. 1901

Melville, George, 14 Princes square. 1901

Menzies, Thos, Hutchesons' Grammar School, Crown street. 1859

Menzies, William Crawford, City Improvement Trust, 34 Trongate. 1895

630 Metcalfe, John Ramsay, 19 Montgomery quadrant. 1901

Millar, A. D., H.M. Inspector of Schools, 20 Wilson street, Hillhead. 1901

Millar James, 158 Parliamentary rd. 1870

*a*Miller, Alexander Wingate, 79 West Nile street. 1900

Miller Alexander, jun., Broomhill, Partick. 1899

635 Miller, A. Lindsay, 122 Wellington street. 1878

*a*Miller, Arch. Russell, Castlebank, Bothwell. 1884

Miller, Hugh, M.A., 3 Westminster terrace, Ibrox. 1901

Miller, James, 5 Hanover street. 1900

Miller, Major, David S., 8 Royal crescent, W. 1887

640*a*Miller, George, Winton drive, Kelvinside. 1881

Miller, G. J., Frankfield, Shettleston. 1888

*a*Miller, J. C., 40 West Nile street. 1900

Miller, John, M.D., 323 Springburn road. 1900

*a*Miller, Thomas Hodgson, 17 Bute gardens, Hillhead. 1901

645*a*Miller, Thos P., Cambuslang Dyeworks. 1864

Mirrlees, James B., Redlands, Kelvinside. 1866

*a*Mirrlees, William J., 45 Scotland st. 1889

Mitchell, Alexander Brown, Avon Bank house, Larkhall. 1901

Mitchell, Andrew, C.A., The Glasgow District Subway Co., St Enoch square Station. 1896

650*a*Mitchell, George A., F.R.S.E., 5 West Regent street. 1883

Mitchell, Nelson, 3 Great Western terrace. 1898

Mitchell, Wm James, M.A., B.L., 49 West George street. 1897

Mitchell, J. O., LL.D, 7 Huntly gardens. 1899
*a*Moffatt, Alexander, 23 Abercromby place, Edinburgh. 1874
655 Mollison, James, 30 Balshagray aven., Partick. 1889
*a*Mond, Robert Ludwig, B.A. (Cantab.), F.R.S.E., 20 Avenue road, Regent's park, London, N.W. 1890
*a*Monro, T. K., M.A., M.D., F.F.P.S.G., 10 Clairmont gards. 1897
*a*Monteith, Robert, Greenbank, Dowanhill gardens. 1885
Moore, Alexander, C.A., 50 Montgomerie drive, Kelvinside. 1869
660 Moore, Alexander George, M.A., B.Sc., 13 Clairmont gardens. 1886
Morrice, Jas A., 1 Prince's ter., Dowanhill. 1883
Motion, James Russell, 38 Cochrane street. 1887
Motion, Thomas Mason, 6 Melrose street, Great Western road. 1897
Muir, Alex., 400 Eglinton street. 1883
665*a*Muir, Allan, Ardmay, Newlands road, Langside. 1881
Muir, Matthew Greenlees, 12 Waterloo street. 1901
Muir, Sir John, Bart, 22 West Nile street. 1876
Muir, Robert, M.D., F.R.C.P.E., Professor of Pathology in Glasgow University, 4 Alfred terrace, Hillhead. 1899
*a*Muirhead, Andrew Erskine, Cart Forge, Crossmyloof. 1873
670 Muirhead, James, 2 Bowmont gardens, Kelvinside. 1887
*a*Muirhead, Robert F., M.A., B.Sc., 24 Kersland street, Hillhead. 1879
Munro, Alexander, M.B., C.M., 569 Gallowgate. 1900
Munro, Daniel, F.S.I., 10 Doune terrace, Kelvinside. 1867
Munro, Donald Mackay, 88 St Vincent street. 1901
675 Munro, J. M. M., M.Inst. E.E., M.Inst.C.E., F.R.S.E., 136 Bothwell street. 1896
Munsie, George, 109 Virginia place. 1871
Munsie, Robert George, 109 Virginia place. 1883
Murdoch, George, 40 St Vincent place. 1894
Murdoch, John, writer, 208 West George street. 1901
680*a*Murdoch, Robert, 91 Maxwell road. 1880
*a*Murray, Daniel, 5 Wilton crescent. 1896
*a*Murray, David, LL.D., 105 West George street. 1876
Murray, James, 144 Craigpark street, Dennistoun. 1901
Murray, John Bruce, 24 George square. 1890
685 Murray, James, 144 Craigpark, Dennistoun. 1901
Napier, Alex., M.D., F.F.P.S.G., Rose Bank, Queen Mary avenue, Crosshill. 1886
Napier, James, M.A., F.R.S.E., The Drums, Old Kilpatrick. 1900
Napier, Robert T., 75 Bothwell street, Glasgow. 1899
Neilson, Archibald Garibaldi, 9 Hillside gardens, Partickhill. 1901
690*a*Neilson, George, 34 Granby ter. 1897
*a*Neilson, James, 116 Bishop street, Port-Dundas. 1896
*a*Neilson, John, Mollance, Castle-Douglas. 1900
*a*Neilson, Walter, Ewenfield, Ayr. 1900
Neilson, William, 27 Robertson street, Greenock, 1899
695 Nelson, Alex., 80 Gordon street. 1880
*a*Nelson, John E., 26 Queen street. 1900
Nelson, Thos C., Craiglea, Dennistoun. 1900
*a*Newlands, Joseph F., 28 Renfield st. 1883
Nicol, James Monro, 93 Cheapside street. 1901
700 Nicoll, James H., M.B., 4 Woodside place. 1897
Nish, Robert, 9 Claremont terrace. 1897

Orr, George Smith, 58 Renfield street. 1901
Orr, John, 107 Wellington street. 1901
Orr, Robert, 79 West Nile street. 1890
705*a*Osborne, Hugh, 4 Kew terrace, Glasgow. 1899

Palgrave, A. G., 17 Wilton mansions, Kelvinside, N. 1900
Park, James, 51 Milburn street. 1877
*a*Park, Lieut.-Colonel James Smith, V.D., 61 Hamilton drive. 1900
Park, Robert, M.D., 40 Grant street. 1894
710 Parker, Edward H., 11 Strathmore gardens, Hillhead. 1897
*a*Parker John Dunlop, C.E., 146 West Regent street. 1889
Parker, James H., B.L., C.A., 89 West Regent street. 1900
*a*Parnie, William, 27 Union street. 1897
Parry, Robert Henry, F.R.C.S.E., 3 Royal crescent, Queen's Park. 1900
715*a*Paterson, Robert, C.A., 28 Renfield street. 1881
Paterson, Wm, 43 Millbrae Road, Langside. 1902

Paton, James, F.L.S., Corporation Galleries and Kelvingrove Museum. 1876

Patrick, Joseph, M.A., C.A., 203 West George street. 1893

Patrick, Joseph, of Alex. Kay & Co., Royal Exchange buildings. 1900

720 Patterson, T. L., F.C.S., Maybank, Finnart street, Greenock. 1873

Peacock, T. Reid, 122 Wellington street. 1898

Peck, James W., M.A., Arnott Demonstrator in Natural Philosophy, Glasgow University, Newington, South Brae drive. 1899

Petrie, Alexander, I.A., 134 Wellington street. 1885

Petrie, John W., 83 Oxford drive. 1900

725 Pettigrew, Andrew H., Chesters, Bearsden. 1902

Pinkerton, John, M.D, Q.H.P., Surgeon-General, Queen's Park House, Langside. 1900

*a*Pirrie, Robert, 9 Buckingham ter. 1875

Playfair, David James, 7 Victoria crescent, Dowanhill. 1901

Pollock, A. Barr, 3 Belgrave terrace, Hillhead. 1897

730*a*Pollock, R., M.B., C.M., F.F.P.S.G., Laurieston house, Pollokshields. 1883

Powell, James, Newlands School. 1900

Procter, Robert, Claremont, Alloa. 1901

*a*Provan, James, 92 West Nile st. 1868

Provand, A. D., M.P., 2 Whitehall court, London, S.W. 1888

735 Raalte, Jacques Van, Baltic Chambers, 50 Wellington street. 1884

Raleigh, Professor Walter, M.A., of Glasgow University, 2 South Park terrace. 1901

*a*Ralston, William Henry, 4 North Court, Royal Exchange. 1900

Ramsay, G. G., LL.D., Litt. D., Professor of Humanity in Glasgow University, 6 The College. 1900

Ramsay, William, 11 Wilton mansions, Kelvinside, 1899

740 Ramsey, Robert, 14 Park terrace. 1889

*a*Ramsey, Robert, jun., 14 Park terrace. 1898

Rankin, The Rev. W. M., B.D., clergyman, 8 Craigpark, Dennistoun. 1900

Rankine, Adam, Russell, Macfarlane & Co., Ltd., 47 Queen street. 1901

Rankine, David, C.E., 238 West George street. 1875

745 Rattray, Rev. Alex., M.A., Parkhead Parish, 4 Westercraigs, Dennistoun. 1879

Rattray, William A., 233 Hope st. 1890

*a*Reid, Andrew Thomson, 10 Woodside terrace. 1900

Reid, David, 16 Cambridge street. 1887

*a*Reid, Hugh, Belmont, Springburn. 1880

750 Reid, James, 15 Montgomerie crescent. 1886

*a*Reid, Joseph, 32 Newark drive, Pollokshields. 1901

*a*Reid, Nicholas M'Whirter, 7 Oakley terrace, Dennistoun. 1901

Reid, Robert, C.A., 40 St Vincent place. 1900

Reid, Thos, M.D., LL.D., 11 Elmbank street. 1869

755 Reid, William, M.A., 61 Grant street. 1881

*a*Reid, William L., M.D., 7 Royal crescent, West. 1882

Reith, Rev. George, M.A., D.D., Free College Church, 37 Lynedoch street. 1876

Renton, James Crawford, M.D., L.R.C.P. & S.Ed., 1 Woodside terrace. 1875

*a*Rennie, John, Wellcroft, Helensburgh. 1901

760*a*Renwick, Wm, Langgarth, Stirling. 1901

Rey, Hector, B.L., B.Sc., 59 Cecil street, Hillhead. 1889

Richmond, Thos, L.R.C.P.E., 22 Holyrood crescent. 1887

Rigg, R. A., 95 Buchanan street. 1900

Ritchie, Geo., Parkhead Forge and Steel Works. 1890

765 Robb, George, carting superintendent, Caledonian Railway. 1901

Robb, John, Busby house, Busby. 1897

Robb, William, F.R.C.V.S., 6 Canning place, Stirling road. 1900

*a*Roberton, William, 209 Sauchiehall street, Glasgow. 1899

Robertson, Alex., M.D., F.F.P.S.G., 11 Woodside crescent. 1900

770*a*Robertson, Henry Tod, Meadowbank, Airdrie. 1901

Robertson, John, Woodside school, and Endcliffe, Langside, *Hon. Lib.* 1860

Robertson, J. M'Gregor, M.A., M.B., C.M., 26 Buckingham ter., Hillhead. 1881

Robertson, Mure, M.E., 4 Clairmont gardens. 1897

*a*Robertson, Robert, B.Sc., M.Inst. C.E., M.I.E.E., etc., 154 West George street. 1900

775 Robertson, Robert H., Clyde bank, Rutherglen. 1888

Robertson, William, C.E., 121 St Vincent street. 1869

Robertson, Wm, 15 Gordon street. 1900

Robinson, Rev. Alexander, M.A., B.D , Auchengray, Crieff. 1901
Robinson, Thomas, The Villas, Hurlet, Nitshill. 1901
780 Rodger, Anderson, Glenpark, Port-Glasgow. 1899
Roemmele, C. H., 34 Kelvinside gardens. 1900
*a*Rogers, John C., 224 St Vincent street. 1888
Rose, Alexander, Richmond house, Dowanhill. 1879
Rose, Hugh, 26 Eglinton drive. 1900
785*a*Ross, John, 9 Westbourne gardens. 1885
Ross, John Munn, C.A., 115 Wellington street. 1894
Ross, Russell James, manager, Parkhead Steel Works, 8 Ashfield gardens, Jordanhill. 1901
Ross, William, 10 Regent place, Shawlands. 1893
*a*Rottenburg, Paul, LL.D., 55 West Regent street. 1872
790 Rowan, James, 22 Woodside place. 1897
Rowan, John, M.B., F.F.P.S.G., 9 Blythswood square. 1900
Rowan, W. G., 234 West George street, 1881
*a*Rowley, Thos, Campbell street, Govan. 1901
Runciman, Alex., 45 Renfield street. 1900
795 Rundell, R. Cooper, Underwriters' Room, Royal Exchange. 1877
Russell, Robert, M.E., Coltness Iron Co., Ltd., Newmains, Lanarkshire. 1901

Salmon, W. Forrest, F.R.I.B.A., 53 Bothwell street. 1870
*a*Samuel, John Smith, secretary to the Lord Provost of Glasgow, City Chambers. 1901
Sandeman, B., Ferndean, Lenzie. 1900
800 Sawers, William D., Assoc.I.C., Athole gardens. 1894
Sayers, William Brooks, M.I.E.E., 189 St Vincent street. 1890
Schmidt, Alfred, 508 New City road. 1881
Scott, Alexander, M.D., Waverley Lodge, Tollcross. 1900
Scott, Alex., 34 Lawrence street, Dowanhill. 1871
805*a*Scott, D. M'Laren, 2 Park quadrant. 1881
Scott, John, 245 Sauchiehall street. 1892
Scott, Robert, I.M., 155 Wellington street. 1884
Scott, Robert, 8 Buchanan street. 1901
Scougal, Andrew E., M.A., 14 Kelvin Drive, Kelvinside, N. 1899
810 Seligmann, Hermann L., 59 St Vincent street. 1850
Seligmann, Hermann Leo, Jun., 105 West George street. 1900
Sellar, Charles, B.L , 65 Bath street. 1901
*a*Service, Edward, 92 St Vincent street. 1901
Service, R. Gibson, 14 Royal Exchange buildings. 1900
815*a*Service, William, 1 Queen's gate, Dowanhill. 1900
Sexton, A. Humboldt, F.C.S., F.I.C., F.R.S.E., Professor of Metallurgy, Glasgow and West of Scotland Technical College, 204 George street. 1892
*a*Shanks, J. B., 46 Gordon street. 1900
Shanks, John Cochrane, 26 West Nile street. 1899
*a*Shaw, A. M'Innes, 8 Kelvinside terrace, N. 1900
820 Shaw, William, 17 Woodside crescent. 1900
*a*Shearer, Wm, 108 St Vincent street. 1901
*a*Sherriff, George, Carronvale, Larbert, Stirlingshire. 1900
Shields, Daniel, 104 West George street. 1900
Simons, Michael, 206 Bath street. 1880
825 Simons, William, M.I.N A., Sherbrook, Tighnabruaich, Argyllshire. 1900
*a*Simpson, J. C., M.D., 9 Marlborough terrace, Kelvinside. 1896
Sinclair, Alexander, Ajmere lodge, Langside. 1883
Sinclair, John, 150 Buchanan st. 1898
Sloan, George, 53 Bothwell street. 1900
830 Sloan, Samuel, M.D., 5 Somerset place.
Sloane, F. N., C.A., 187 West George street. 1893
Smart, William, M.A., LL.D., Professor of Political Economy, University of Glasgow, Nunholm, Dowanhill. 1886
Smellie, George, I.M., 167 St Vincent street. 1880
Smellie, James, I.M., 112 Bath street. 1901
835*a*Smith, Andrew, Miltonlea, Kilmalcolm. 1901
Smith, Colonel J. N , V.D., Dykebar house, Hawkhead, Paisley. 1900
Smith, D. Johnstone, C.A., 149 W. George street. 1888
*a*Smith, Fred. J., 40 St Vincent place. 1901
Smith, George, 1 Annfield terrace, East Partick. 1901

840 Smith, Hugh C., 55 Bath street. 1861
*a*Smith, J. Guthrie, 205 St Vincent street. 1875
*a*Smith, James Murray, 11 Bute gardens. 1901
Smith, Patrick A., M.D., F.F.P.S.G., J.P., Dundrennan, 50 Queen Mary avenue, Crosshill. 1900
*a*Smith, Robert B., Bonnybridge, Stirlingshire. 1884
845*a*Smith, W.B., 34 Buchanan street. 1895
Snodgrass, J. F., Ashbourne, Winton drive, Kelvinside. 1900
Snodgrass, William, M.A., M.B., C.M., F.F.P.S.G., 11 Victoria cres., Dowanhill. 1890
*a*Somerville, Alex., B.Sc., F.L.S., 4 Bute mansions, Hillhead. 1888
Sorley, Robert, 93 St Vincent st. 1878
850*a*Spencer, Charles L., Edgehill, Kelvinside. 1891
*a*Spencer, J. J., Edgehill, Kelvinside. 1895
Spens, John A., 105 W. George street. 1879
Steel, James, M.A., 502 St Vincent street. 1901
*a*Steel, William Strang, Philiphaugh, Selkirk. 1889
855*a*Stephen, John, Domira, Partick 1880
Sterling, John Lockhart, 30 Ashton gardens, 1901
Steven, Alexander Kay, Westmount, Kelvinside. 1897
Steven, Henry, 20 Ingram street. 1900
*a*Steven, Hugh, Westmount, Montgomerie drive. 1869
860 Steven John, 32 Elliot street. 1875
Steven, J. H., Beechcroft, Stirling. 1897
*a*Stevenson, D. M., 12 Waterloo street. 1889
*a*Stevenson, Jas, LL.D., F.R.G.S., 23 West Nile street. 1870
Stevenson, John, 41 Albert terrace, Trinity, Edinburgh. 1892
865 Stevenson, Robert, M.D., 12 Merton road, Bootle. 1898
Stevenson, Samuel, 4 Royal terrace, Crosshill. 1902
Stevenson, Wm, 13 Carlton place. 1888
Steuart, Daniel Rankine, Osborne cottage, Broxburn, West Lothian. 1877
Stewart, Allan Alfred, 180 Hope street. 1901
870 Stewart, Archibald, Marnock villa, Queen's drive, Crosshill. 1892
Stewart, David, 3 Clifton place. 1856
Stewart, Duncan, 14 Windsor terrace, Kelvinside. 1901
Stewart, John, 220 Parliamentary road. 1899
Stewart, Robert, Newark, Partick. 1899
875*a*Stewart, Robertson Buchanan, 146 Argyle street. 1901
Stewart, Walter, jun., M.A., D.Sc., Chief Assistant to the Professor of Natural Philosophy, Glasgow University, Gartsherrie, Coatbridge. 1899
*a*Stewart, William, Kelvinhaugh street. 1901
*a*Stobo, Thomas, Somerset house, Garelochhead. 1884
Stockdale, H. F., Clairinch, Milngavie. 1899
880 Stockman, Ralph, M.D., F.R.S.E., Professor of Materia Medica, The University of Glasgow. 1897
Stoddart, James Edward, Howden, Mid-Calder, N.B. 1872
Story, The Very Rev. R. H., D.D., Principal of the University of Glasgow. 1899
Strachan, George, Fairfield Works, Govan. 1900
Strachan, R. U., Sheriff-Substitute, 10 Crown circus. 1896
885*a*Strain, James M., 15 Kingsborough gardens, W. 1900
*a*Strain, John, C.E., 154 W. George street. 1876
Strathie, David, C.A., 162 St Vincent street. 1895
*a*Sutherland, David, Balmaccara Hotel, Lochalsh. 1880
*a*Sutherland, John, Columba Hotel, Oban. 1880
890 Sutherland, J. R., C.E., 45 John street. 1884
Swan, Charles C., 15 Rose street, Garnethill. 1891

Tait, William, 43 Keir street, Pollokshields. 1902
Tatlock, John, F.I.C., 13 Parkgrove terrace, West, Sandyford. 1875
Tatlock, Robert R., F.R.S.E., F.I.C., F.C.S., 156 Bath street. 1868
895 Taylor, Benjamin, F.R.G.S., 10 Derby crescent, Kelvinside. 1872
Taylor, J. M., Dean of Faculty of Procurators, Northbank, Kelvinside. 1900
*a*Teacher, John H., M.B., C.M., 32 Huntly gardens. 1898
Temple, Edwin, B.A.Cantab., Rector of Glasgow Academy. 1899
Templeton, James, 2 Claremont terrace. 1900
900Templeton, John Stewart, William street, Calton. 1900
Tennant, Sir Charles, Bart, 142 West Nile street. 1868

Tennent, Gavin P., M.D., 195 Bath street. 1875
Thom, R. Wilson, 8 Woodside terrace. 1898
Thomas, Moses, M.D., Superintendent, Royal Infirmary. 1890
905 Thomson, R. S., M.D., D.Sc., Professor of Medicine (Anderson's Medical College), 3 Melrose street. 1901
Thomson, Alexander, M.B., C.M. (Edin.), 8 Hamilton Park terrace, Hillhead. 1900
Thomson, George C., F.C.S., 53 Bedford Road, Rock Ferry, near Birkenhead. 1883
Thomson, George, Tureen Street Public School. 1900
Thomson, Gilbert, M.A., C.E., 164 Bath street. 1885
910 Thomson, Samuel M., M.A., 208 West George street. 1900
Thompson, Professor G. R., B.Sc., Victoria University, Manchester. 1895
*a*Thomson, James, F.R.I.B.A., 88 Bath street. 1886
*a*Thomson, James M., Montgomerie, Tarbolton, Ayrshire. 1892
Todd, John Aiton, B.L., 190 West George street. 1897
915 Townsend, C. W., Crawford street, Port-Dundas. 1890
Trotter, John, 28 Gordon street. 1899
*a*Tullis, David, St Ann's Leather Works, Bridgeton. 1894
*a*Tullis, James Thomson, Anchorage, Burnside, Rutherglen. 1883
*a*Tullis, John, John street, Bridgeton. 1900
920*a*Turnbull, John, jun., M.I.M.E., 18 Blythswood square. 1883
Turnbull, Robert, 122 Wellington street. 1895
Turner, William, Barnfrow, Helensburgh. 1875
Turpie, John, 339 Sauchiehall street. 1896

Ure, William P., Regent Mills, Sandyford. 1893

925*a*Waddell, Robert Davidson, Rednock, Kelvinside, W. 1901
Walker, Adam, 26 Newton place. 1880
*a*Walker, Archibald, M.A.(Oxon.), F.I.C., F.C.S., 8 Crown terrace, Dowanhill. 1858
Walker, James A., 206 Bath street. 1898
Walker, John Allan, Art Master, Allanbank, Abbey Drive, Jordanhill. 1901
930 Walker, J. W. O., 63 Montgomerie street, Kelvinside. 1896
*a*Walker, William H., Cardarroch House, Airdrie. 1900
*a*Wallace, Hugh, Bank of Scotland, 544 St Vincent street. 1879
Wallace, James Wilson, M.D., C.M., Cairnsmore, 67 St Andrew's drive, Pollokshields. 1900
Wallace, William, M.A., LL.D., barrister-at-law, 36 Lilybank gardens, W. 1900
935*a*Wallace, Wm, M.A., M.B., C.M., 25 Newton place. 1888
*a*Wardlaw, Alex., The Clydesdale Bank, Ltd. 1900
Warren, John A., C.E., 94 Hope street. 1887
Watkinson, Wm H., Whit. Sch., M.Inst.,Mech.E., Professor of Steam and Steam Engines in the Glasgow and West of Scotland Technical College, The Pines, Crookston. 1893
Watson, Archibald, 5 Westbourne terrace. 1881
940 Watson, George Louden, 109 Hope street. 1901
Watson, Harold, 9 Holland place. 1901
Watson, James, 6 Kirklee road, Kelvinside, W. 1873
Watson, John, National Bank, Crosshill. 1900
*a*Watson, John, 205 West George street. 1886
945 Watson, Joseph, 225 West George street. 1882
*a*Watson. J. Robertson, M.A., Professor of Chemistry, Anderson's College Medical School, Dumbarton road. 1891
*a*Watson, Thomas Lennox, I.A., F.R.I.B.A., 166 Bath street. 1876
Watson, William, Gartmore, Langside. 1897
*a*Watson, William W., 5 Westbourne terrace. 1899
950 Watt, Alexander, 183 St Vincent st. 1900
Webster, H. Carvick, 48 Montgomerie drive. 1900
Webster, Rev. John M'Kessor, M.A., The Manse, Row, Dumbartonshire. 1901
*a*Weir, William, Shewalton, Dreghorn. 1901
Welsh, John M., Ph.D., F.E.I.S., F.R.G.S., 4 Prospecthill, Langside. 1897
955 Welsh, Thomas M., 3 Prince's gardens, Dowanhill. 1883

Wenley, James A., 5 Drumsheugh gardens, Edinburgh. 1870
White, J. Walls, M.D., Brunalb, Uddingston. 1900
White, John, Scotstoun Mills, Partick. 1897
Whitelaw, William, Hope Cottage, Crookston. 1897
960 Whitson, Arthur, 77 St Vincent st. 1901
*a*Whitson, Jas, M.D., F.F.P.S.G., 13 Somerset place. 1882
Whyte, A. C., L.D.S., 42 Dundas street. 1892
Whyte, John Laurie, 5 Mansion House road, Langside. 1900
Wield, John, 9 Barns street, Ayr. 1895
965 Williamson, John, 65 West Regent street. 1881
Wilson, Alex., Hydepark Foundry, 54 Finnieston street. 1874
*a*Wilson, David, M.A., D.Sc., F.C.S., Carbeth, Killearn. 1898
Wilson, Thomas, 142 West George street. 1901
Wilson, Thomas F., 129 St Vincent street. 1901
970 Wilson, Walter Stuart, 4 St John's terrace. 1901
Wilson, Wm, F.E.I.S., Schoolhouse, Pavenham, Bedford. 1889
Wingate, Arthur, 10 Prince's gardens, Dowanhill. 1882
Wingate, Walter E., 4 Bowmont ter. 1880
Wood, Adam, Portland villa, Troon. 1901
975 Wood, James, Dunard Street Public School, 2 Cresswell terr., Uddingston. 1900
Wood, James, M.A., Glasgow Academy. 1885
*a*Wood, William James, 38 Cochrane street. 1893
Woodrow, Alexander, 75 Glassford street. 1900
Woodrow, Alexander Norie, 75 Glassford street. 1900
980*a*Workman, Chas, M.D., F.F.P., & S.G., Professor of Pathology, St Mungo's College, 5 Woodside terrace. 1898
Woyka, John William, 241 Govan street. 1901
Wright, Robert Patrick, Professor of Agriculture, West of Scotland Agricultural College, 6 Blythswood square. 1895
Wylie, William A., 13 Woodside terr. 1901
Wyper, James, Nithsdale Lodge, Pollokshields. 1900

985 Yellowlees, D., M.D., LL.D., 6 Albert gate. 1881
Youden, John, 12 Bothwell st, Glasgow, and Hazelwood, Giffnock. 1901
Young, Alfred A., M.A., M.B., 10 Hamilton Park terrace. 1899
Young, David, M.D., Linton Villa, Parkhead. 1900
Young, Frank W., H.M. Inspector of Schools, 32 Buckingham terrace. 1902
990*a*Young, James, jun., Caerleon, Bearsden. 1900
*a*Young, John E., 24 Belhaven terrace, Kelvinside. 1900
Young, John, 8 Athole gardens, Kelvinside. 1900
Young, John, 42 Bath street. 1900
Young, John, 2 Montague terrace, Kelvinside. 1885
995 Young, John, 88 Renfield street. 1881
*a*Young, John, jun., M.A., B.Sc., 61 Clyde street, Anderson. 1887
Younger, George, 166 Ingram street. 1847
Yuill, John Weir, Glenmill house, Campsie Glen. 1901

INDEX.

Absorption lines and homogeneous vibrations, Schuster on, 32.
Accent in poetry, origin of, 269.
Account, abstract of Hon. Treasurer's, for session 1900-1901, 324, 325.
Agriculture in the "Thirties," 254
Allen, H. Stanley, on the potential difference necessary for a double spark gap, 215; on the photography of sound and other disturbances in air, 71.
Alliterative verse, early, John Clark on, 269.
Alliteration, rule of three in, 273.
American probation system, 105; system of reformatories, 104.
Amours, F. J., on Editions and MSS. of Wyntoun's "Cronykil," 219.
Apartments, relative cost of large and small, 139.
Artizan's house, type of, 125; cost of, 138.
Assyrians in the Judith, the, by David H. Crawford, 209.
Athenian treasure, 89.
Atomic decomposition, Lockyer's hypothesis of, 20

Babylon, credit system in, 88.
Bacillus of plague, the discovery of, 169; in the body, 169; cultivation of in artificial media, 170.
Balfour of Burleigh, Lord, letter from, 318.
Barr, Professor, on the housing problem, 162; elected President of the Society, 323.
Bertillon system of identification, 103
Blyth, Professor James, on additional experiments with the electric sonometer, 267.
Blythswood, Lord, vote of thanks to, 319.
Borthwick, James, appointed auditor, 319; vote of thanks to, 328.
Brightness, intrinsic, and density of a star, 25.
Brown, J. T. T., on Huchown of the Awle Ryale, 315.
Buchanan, Dr Robert M., on Plague in some of its historical and present day aspects, 163.
Building, cost of, effect on rent, 137.
Burial in Scotland in the "Thirties," 261.
Bursaries, scheme of, 62.

Capital punishment in the "Thirties," 264.
Carlile, W. W., on the relation of Economics to Numismatics, 81.
Central classes for teachers, 42, 44, 45, 46.
Chaucerian investigations, recent, W. S. M'Cormack on, 314.
Chromosphere, sun's, 12.
Clark, John, on early alliterative verse, 269.
Coins, Hunterian collection of, 91.
Committees appointed by the Council, list of, 343.
Consonantal sounds of the English language, on a model for exhibiting a classification of, by R. F. Muirhead, 232.
Convection Currents, 6, 20.
Convective equilibrium, 7; gaseous sphere in, 10.
"Coortin'" in the "Thirties," 259.
Correctional system, elements of, 102.
Corresponding Members elected, 319, 329, 336.
Council, report of, for session 1900-1901, 320.
Crawford, David H., on the Assyrians in the Judith, 209.
Credit system in Babylon, 88.
"Cronykil," Wyntoun's, editions and MSS. of, by F. J. Amours, 219.
Criminal saturation, law of, 106.
Criminal anthropology, 95; sociology, 95.
Criminal, the, some social and economic aspects, by W. Millar Douglas, 93; normal type of, 96, 97; classes of, 98; correctional agencies for, 98; habitual offenders, 102; and the housing problem, 150.
Criminals, juvenile, 106, 107, 108.

Density and intrinsic brightness of a star, 23.
Disruption, David Lamb on the, 266.
Dwellings Company, Glasgow workman's, 131, 149; typical houses of, 129, 131, 133.

Eadie, George, on the housing problem, 156
Earth and sun, electrification of, 15.
Economics, relation of, to Numismatics, W. W. Carlile on, 81.
Editions and MSS. of Wyntoun's "Cronykil," by F. J. Amours, 219.
Education, degeneration of, 38; statistics of, 38.
Educational Institute of Scotland on the training of teachers, 68.
Election, curious, in 1830, 251.
Electric Sonometer, experiments with, by Professor Blyth, 267.

Electrification of sun and earth, 15.
Emissivity, thermal, by J. W. Peck, 110.
Energy, solar, maintenance of, 18.
Epidemic centres of plague, 166.
Errata, viii.
Evolution of Solar stars, by Prof. Schuster, 1.
Examinations, scheme of training college, 54; scheme of leaving certificate, 55; scheme of university, 55.
Exchanges, list of, 350.
Ex-P. T., origin of, 41.

Factory system of training teachers, 42.
Faculae and solar prominences, 19.
Falconry in the "Thirties," 262.
Farmer, the Scotch, in the "Thirties," 255.
Fergus, Dr Freeland, re-elected Hon. Secretary, 323.
Ferguson, Professor John, on Joannes Matthæus and his tract, "De Rerum Inventoribus," 180.
Finance, committee on, 343.
Finlay, James, jun., on the housing problem, 160.
Finlayson, Dr James, elected a Member of Council, 323.
Foodstuffs as money, 83.
Foveation (vaccination), 298.
Flame disturbances in air, photography of, 78.
Flux, radiation, dependent variables of, 112.
Fraser, William, on rents and ground rents, 124.
Fullarton, Dr Robert, and Professor R. S. Thomson, on a summary of statistics relating to vaccination and smallpox, 287.

Gas, highest velocity of, 13.
Gaseous sphere in convective equilibrium, 10
Gawayne and Golagros, history in the romance of, by George Neilson, 234.
Genealogy of MSS. and texts, by W. S. M'Cormick, 314.
Giustiniani, Augustini, 195.
Golagros and Gawayne, history in the romance of, by George Neilson, 234.
Gold and silver as standard, 90.
Graham Medal and Lecture Fund, abstract of Hon. Treasurer's account of, 326.
Graham Medal, rules governing the competition for, 317.
Ground values, effect of, on rent, 136.

Habitual offenders, 102.
Hanbidge, James E., appointed auditor, 319; vote of thanks to, 328.
Historical and Philological Section, constitution of, 335.
Homogeneous vibrations and absorption lines, Schuster on, 32.
House Committee, 343.
House, artizan's, type of, 125; cost of, 138.
Housing Problem, the, facts and figures bearing upon, by William Fraser, 124; and the criminal, 150.
Housing problem, the general, 146.
"Housing Problems," discussion on, 144; Prof. Smart on, 144; Jas R. Motion on, 153; John A. Todd on, 155; H. A. Mavor on, 155; Dr John M'Vail on, 156; George Eadie on, 156; Hugh Mayberry on, 158; John Mann, jun. on, 159; James Finlay, jun on, 160; J. H. Kelly on, 160; Councillor Kennedy on, 161; Professor Barr on, 162.
Huchown of the Awle Ryale and his poems, by J. T. T. Brown, 315.
Huggins on stellar spectra, 20, 21.
Hydrogen and solar stars, comparative temperatures of, 17, 22; difference between, 22; comparative densities of, 24.
Hydrogen stars in the Milky Way, 26.

Identification, Bertillon system of, 103.
Income tax and rental, 140.
Index, 379-383.
Industrial schools and reformatories, 103.
Infection, transmission of plague, 171.
Inoculation, protective, for plague, 176.

Intrinsic brightness and density of a star, 23.
"Inventoribus, De Rerum," Professor Ferguson on, 180.
Inventoribus, De Rerum, Libellus, 196.
Italian verse, alliteration in, 283.

Joannes Matthæus and his tract "De Rerum Inventoribus," by Professor John Ferguson, 180
Judith, the Assyrians in the, by David H. Crawford, 209.
Juvenile Criminals, 106, 107, 108.

Kelly, J. H., on the housing problem, 160.
Kennedy, Councillor, on the housing problem, 161.
King's studentships, 59, 60, 61.
King's students, the training of, 66.
Kirk, the, in the "Thirties," 264-266.
Knight, James, elected a Member of Council, 323.
Knight, James, on the training of teachers in Scotland, 37.

Lamb, David, on rural and Suburban life in Scotland in the "Thirties," 250.
Latin and Italian verse, alliteration in, 281.
Latin, higher grade, for teachers, 64.
Leaving certificate, scheme of examinations, 55.
Library, Committee on the, 343.
Library, additions to, 344-350; list of periodicals in the, 358.

Library Committee, report of, for session 1900-1901, 321.
Lindsay, A. M., elected a Member of Council, 323.
Living room, cheapest rent of adequate, 141.
Lockyer's hypothesis of atomic decomposition, 20.
Lunensis, Joannes Matthæus. 190.

Macbean, Edward, admitted, 318.
M'Cormick, W. S., on the Genealogy of MSS. and texts, with especial reference to recent Chaucerian investigations, 314.
Macfarlane's law of emissivity, 122.
Maclean, Professor M., elected Vice-President, 323.
M'Vail, Dr John, on the housing problem, 156.
Mann, John, re-elected Hon. Treasurer, 323.
Mann, John, Jun., on the housing problem, 159.
Marriage in Scotland in the "Thirties," 259, 260.
Marriages, "Portpatrick," 260.
Matthæus Joannes, Professor Ferguson on, 180.
Matter, original distribution of, in space, 29.
Mavor, H. A., on the housing problem, 155; elected a Member of Council, 323.
Mayberry, Hugh, on the housing problem, 158.
Members of the Society—honorary, 361; corresponding, 362; ordinary, 362-378.

New :—

Corresponding.

M'Cormick, W. S., 336.
Mills, Professor Edmund J., 319.
Schuster, Professor Arthur, 329.

Ordinary.

Anderson, James Scott, 332
Anderson, James Spencer, 330.
Brownlie, John Douglas, 328.
Buchanan, George Douglas, 328.
Corrie, David, 338.
Duthie, Andrew Drummond, 336.
Dalrymple, James D. G., 331.
Downie, Dr Walker, 328.
Elliott, Joseph J., 328.
Ewan, Thomas, 330.
Gemmill, Dr James Fairlie, 330.
Gray, Alexander, 319.
Gunn, John, 330.
Guthrie, James, 319.
Harrington, John C., 328.
Hart, Robert, 339.
Kennedy, Alexander, 331.
Laurie, Professor Malcolm, 328.
Leipper, James, 336.
Macbean, Edward, 318.
M'Callum, Hugh, 331.
Macdonald, James A., 330.
Mackillop, Fred G., 319.
Macleod, Frederick Larkins, 319.
M'Whirter, W., 319.
Medley, Professor Dudley J., 328.
Millar, Hugh, 330.
Miller, A. D., 330.
Miller, Thomas Hodgson, 330.
Murray, James, 318.
Orr, George Smith, 330.
Pettigrew, Andrew H., 336.
Raleigh, Professor Walker, 330.
Sellar, Charles, 319.
Smellie James, 330.
Steel, James, 328.
Stevenson, Samuel, 332.
Tait, William, 332.
Thomson, Professor R. S., 328.
Young, Frank W., 331.

Militia, the, in the "Thirties," 261, 262.
Milky Way, hydrogen stars in, 26.
Minutes of session 1901-1902, 318-339.
Model lodging houses, Lord Provost Chisholm on, 154.
Monck on proper motions of stars, 27.
Money, origin of, 82; foodstuffs as, 83; material of ornament as, 84, 86; Schurtz on, 83; and religion, 85, 87.
Motion, Jas. R., on the housing problem, 153.
Muirhead, R. F., on a model for exhibiting a classification of the consonantal sounds of the English language, 232.
Murray, James, admitted, 318.
Music in schools, 49.

Nebulous bodies, spectra of, 27.
Neilson, George, on history in the romance of Golagros and Gawayne, 234.
Newspaper clubs in the "Thirties," 253.
Numismatics, in relation to Economics, W.W. Carlile on, 81; inducements to the study of, 91.

Office-bearers of sections, 341, 342.
Office-bearers of the Society, 340.
Ornament and money, 86.
Ornament, material of, as money, 84.

Paisley shawl trade, 252.
Pandemic of plague, duration of, 177; spread of present, 167.
Papers, Committee on, 343.
Periodicals in reading-room, 358.
Philological section, change of title of, 328, 329; revised constitution of, 335.
Photography of sound and other disturbances in air, by H. Stanley Allen, 71.
Pickering on classification of stellar spectra. 25.
Plague in some of its historical and present day aspects, by Dr Robert Macneil Buchanan, 163.

Plague, historical references to the diffusion of, 164; epidemic centres of, 166; origin and spread of the present pandemic, 167; characteristics of, as a disease, 167; the discovery of the bacillus of, 169; bacillus of, in the body, 169; bacillus, cultivation of in artificial media, 170; infection, transmission of, 171; diffusion of bubonic, from 1893 to 1901, 174, 175; protective inocu'ation for, 176; treatment of, 176; duration of pandemic, 177.
Portpatrick marriages, 260.
Potential difference necessary for a double spark gap, the. H. Stanley Allen on, 215.
President of the Society, election of, 323.
Prison, the, not a reformatory, Douglas on, 100.
Prison Committee, 100, 101.
Prominences, solar, and faculae, 19.
Proper motions of stars, Monck on, 27.
"Purling," 258.

Radiation flux, dependent variab'es of, 112.
Reformatories and industrial schools, 103.
Reformatories, American system of, 104.
Relation of Economics to Numismatics, by W. W. Carlile, 81.
Religion and money, 85, 87.
Rental and income tax, 140.
Rent, elements of, 125, 128, 131, 134, 142.
Rents and ground rents, by William Fraser, 124.
Report of Library Committee for session 1900-1901, 321.
Report of Council for session 1900-1901, 320.
Revaccination, 289.
"Rinnin' a braise," 260.
Robertson, John, re-elected Hon. Librarian, 323.
Room, adequate living, cheapest rent of, 141.
Rural and suburban life in Scotland in the "Thirties," notes on, by David Lamb, 250.

"Scar area" (vaccination), 288.
School fees in the "Thirties," 257.
Schools in Scotland in the "Thirties," 256.
Schurtz on money, 83.
Schuster, Professor A., elected a corresponding member, 319; on the principle of uniformity, 34; on homogenous vibrations and absorption lines, 32; on the difference between a hydrogen and a solar star, 22; on the evolution of solar stars, 1.
Sections, office-bearers of, elected, 323; list of, 342.
Science Lecture and Graham Medal Trust Fund committee, 343.
Science Lectures Association Fund, abstract of Hon. Treasurer's account of, 327.
Shaw-Maxwell on the housing problem, 153.
Silver and gold as standard, 90.
Smallpox, grades of severity in, 290.
Smallpox patients, classification of, 288.
Smallpox and vaccination, a summary of statistics relating to, by Drs Thomson and Fullarton, 287.
Smart, Professor, on housing problems, 144.
Smuggling in the "Thirties," 256.
Snowstorm in 1838, 254.
Solar and hydrogen stars, comparative temperatures of, 17, 22; comparative densities of, 24.
Solar energy, maintenance of, 18.
Solar prominences and faculae, 19.
Solar stars, evolution of, by Prof. Schuster, 1.
Sonometer, electric, experiments with, by Professor Blyth, 267.
Sounds, consonantal, of the English language, a model for exhibiting a classification of, by R. F. Muirhead, 232.
Sound waves, photography of, by H. Stanley Allen, 71.
Spark gap, double, the potential difference necessary for, by H. Stanley Allen, 215.
Spectra of nebulous bodies, 27.
Spectra, stellar, Pickering on the classification of, 25.
Spectra, stellar, Huggins on, 20, 21.
Star, intrinsic brightness and density of, 23; densities, 25.
Stars, hydrogen and solar, temperatures of, 17, 22; difference between, 22; comparative densities of, 24; surface temperature of, 8; interior temperature of, 9; proper motions of, Monck on, 27; hydrogen, in the Milky Way, 26.
Stellar Spectra, classification, by Pickering, 25.
Studentships, King's, 59, 60, 61.
Students, King's, training of, 66.
Sun and earth, electrification of, 15.
Sun, heat radiation of, 11.

Teachers, former training of, 33; school curricula for, 40; factory system of training, 42; central classes for, 42; duration of apprenticeship of, 43, 46, 47; proposed curriculum for, 63; higher grade Latin for, 64; university degree for, 65.
Teachers in training, curriculum for, 46.
Teachers in Scotland, the training of, James Knight on, 37.
Temperature, comparative, of hydrogen and solar stars, 17, 22.
Teutonic verse, rules of construction of, 273.
Thermal emissivity, by J. W. Peck, 110.
Thermal emissivity, theory of Peck's method, 113; experimental arrangements, 115-119; special feature of method, 121; Macfarlane's law, 122.
"Thirties," rural and suburban life in Scotland in the, notes on, by David Lamb, 250.

Thomson, Gilbert, elected a Member of Council, 323.
Thomson, Professor R. S and Dr Fullarton, on a summary of statistics relating to vaccination and smallpox, 287.
Title of Society, change of, 318.
Toscanus, Joannes Matthæus, list of his works, 186-189.
Todd, John A., on the housing problem, 154.
Trade in the "Thirties," 262, 263.
Training of teachers, E.I.S. committee report on, 68.
Training colleges, 50; curriculum of, 52.
Training colleges, scheme of examinations, 54.
Treasurer's accounts, abstracts of, 324, 325, 326, 327.

Uniformity, the principle of, Schuster on, 34.
University degree for teachers, 65.
University, scheme of examinations, 55.

Vaccination, tabular statements relating to, 292, 294, 295, 296, 297, 298, 299, 300, 301, 303, 307, 308, 309, 311; doubtful cases of, 293; remarkable protective influence of, 306; conclusions from statistics of, 312, 313.
"Vaccination marks," 287.
Vaccination and Smallpox, a summary of statistics relating to, by Drs Thomson and Fullarton, 287.
Velocity of a gas, 13.
Verse, early alliterative, John Clark on, 269.
Vibration, homogeneous, and absorption lines, Schuster on, 32.

Weaving trade in the "Thirties," 251-253.
Workman's Dwellings Company, the Glasgow, 131, 149; types of houses of, 129, 131, 133.
Wyntoun's "Cronykil," editions and MSS. of, by F. J. Amours, 219.

Zebina, gold coins of, 88.

GLASGOW:
CARTER & PRATT,
PRINTERS AND PUBLISHERS
62 BOTHWELL CIRCUS.